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In the Supreme Court of the United States

OCTOBER TERM, 1979

SIDNEY A. DIAMOND, COMMISSIONER OF PATENTS AND TRADEMARKS, PETITIONER

v.

JAMES R. DIEHR, II, AND THEODORE A. LUTTON

PETITION FOR A WRIT OF CERTIORARI TO THE UNITED STATES COURT OF CUSTOMS AND PATENT APPEALS

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INDEX

	Page
Opinions below	1
Jurisdiction	2
Question presented	2
Statute involved	2
Statement	2
Reasons for granting the petition	6
Conclusion	10
Appendix A	1a
Appendix B	19a
Appendix C	20a
Appendix D	26a
Appendix E	38a
Appendix F	63a
Appendix G	73a

CITATIONS

Cases:

Bergy, In re, 596 F.2d 952, cert. granted, No. 79-136 (Oct. 29, 1979)	6, 9
Bradley, In re, 600 F.2d 807	6
Gottschalk v. *Benson*, 409 U.S. 63	4, 5
Parker v. *Flook*, 437 U.S. 584	5, 6, 7, 8, 9, 10
Sherwood, In re, No. 79-579 (C.C.P.A. Jan. 10, 1980)	6

Statute:

35 U.S.C. 101	2, 4

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The Solicitor General, on behalf of the Commissioner of Patents and Trademarks, petitions for a writ of certiorari to review the judgment of the United States Court of Customs and Patent Appeals in this case.

OPINIONS BELOW

The opinion of the Court of Customs and Patent Appeals (App. A, *infra*) is reported at 602 F.2d 982. The opinion of the Patent and Trademark Office Board of Appeals (App. C, *infra*) and the opinions of the patent examiner (App. D, *infra*) are not reported.

JURISDICTION

The judgment of the Court of Customs and Patent Appeals was entered on August 9, 1979, and a timely petition for rehearing was denied on October 18, 1979 (App. B, *infra*). The jurisdiction of this Court is invoked under 28 U.S.C. 1256. *Gottschalk* v. *Benson*, 409 U.S. 63 (1972); *Dann* v. *Johnston*, 425 U.S. 219 (1976).

QUESTION PRESENTED

Whether a computer program that regulates the curing time of rubber products in a mold is patentable subject matter under 35 U.S.C. 101.

STATUTE INVOLVED

35 U.S.C. 101 provides:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

STATEMENT

On August 6, 1975, James R. Diehr, II, and Theodore A. Lutton applied for a patent on a process using a computer for regulating the curing time of rubber products in a mold press (App. E, *infra*, 38a, 41a).[1]

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[1] The invention is assigned to Federal-Mogul Corporation, Detroit, Michigan. Brief for Appellants at 1, *In re Diehr*, 602 F.2d 982 (C.C.P.A. 1979).

Rubber products produced from a mold press are cured in the press for a specified time (App. E, *infra*, 39a-40a). The time needed to obtain a good cure depends in part on the temperature inside the press, which is regulated by a thermostat (*ibid.*).[2] It is possible, using well-known time, temperature, and cure relationships, to calculate when to open the press and remove the cured product (App. E, *infra*, 39a, 49a). Nonetheless, uncontrolled variables present in the actual curing process make it difficult to arrive at an exact temperature for purposes of doing the necessary computations. The time the press is open while it is being loaded, for example, affects the temperature inside the press when it is first closed and thus influences the time it takes to heat the press to the desired temperature (App. E, *infra*, 39a). For this reason, industry practice is to calculate the cure time as the shortest time in which all parts of the product definitely will be cured, assuming a "reasonable amount of mold-opening time" during loading and unloading (App. E, *infra*, 40a). The disadvantages of this practice are that erring on the side of caution will usually lead to overcuring the rubber, while keeping the mold open for more than a "reasonable" time will often result in undercuring (*ibid.*).

Diehr's claimed invention employs a digital computer to overcome these drawbacks. Measurement of

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[2] The geometric configuration of the press and the viscosity of the rubber when it enters the press are also important factors in computing the cure time (App. E, *infra*, 46a-47a, 48a, 49a).

the temperature in the closed, heated press is made "continuously," for example, every ten seconds (App. E, *infra*, 41a). These measurements are automatically fed into the computer (App. E, *infra*, 41a, 45a). For each new measurement, the computer recalculates the cure time in accordance with a well-known mathematical formula, the Arrhenius equation (App. E, *infra*, 41a-42a, 46a). When the recalculated cure time equals the actual time that has elapsed since the press was closed, the computer signals a device to open the press (App. E, *infra*, 42a, 45a). Diehr's claims describe both the method for operating the press using the computer and, more generally, the method for manufacturing molded articles, including the steps of putting rubber into the press, closing and heating the press, and opening the press to remove the molded product (App. E, *infra*, 44a-62a).

The patent examiner rejected the invention as drawn to nonstatutory subject matter under 35 U.S.C. 101 (App. D, *infra*, 26a-37a). He concluded that those steps in Diehr's claims that are "carried out by the computer under control of a stored program" are nonstatutory under *Gottschalk* v. *Benson*, 409 U.S. 63 (1972) (App. D, *infra*, 28a, 33a-34a). The remaining steps—which relate generally to the method of manufacturing precision molded articles, such as the opening, closing, and heating of the mold —the examiner found to be "conventional" (App. D, *infra*, 28a, 33a).

The Patent and Trademark Office Board of Appeals (Board) unanimously affirmed the rejection. The

Board found that Diehr's specifications, while not listing a computer program as such, in fact contained a "sufficient" description from which a "person of ordinary skill in the art" could write a computer program (App. C, *infra*, 21a-22a). Analyzing the claims, the Board found much that was either within the prior art, such as the constant measurement of the mold temperature, or that involved post-solution activity, such as the automatic opening of the press. The "calculation" recited in the claims, observed the Board, shows that Diehr's system employs an algorithm (App. C, *infra*, 22a-24a). The Board summarized: "[T]he only difference between the conventional methods of operating a molding press and that claimed * * * rests in those steps * * * which relate to the calculation incident to the solution of the mathematical problem or formula" (App. C, *infra*, 24a). The Board concluded that this calculation, Diehr's "contribution," was "a computer program of the character" that is nonstatuotry under *Gottschalk* v. *Benson*, *supra*, and *Parker* v. *Flook*, 437 U.S. 584 (1978) (App. C, *infra*, 24a).

The Court of Customs and Patent Appeals (CCPA) reversed. It agreed with the Board that Diehr had "disclosed a computer program" (App. A, *infra*, 5a n.3), but it stated that this "does nothing to aid in the determination of compliance with § 101" (App. A, *infra*, 8a) and is not "of any significance" (App. A, *infra*, 14a). It held that this Court's analysis detailed in *Flook* was merely "a convenient vehicle" for finding the "method[] of calculation" there to be nonstatutory, and did not establish "a

general test in determining compliance with § 101" (App. A, *infra*, 13a-14a n.6). Thus it refused to identify and set aside, as had the Board, those steps in the claim that were old in the art (App. A, *infra*, 13a-14a, 16a-17a), stressing that, "[c]onsiderations of novelty and obviousness have no bearing on compliance with § 101" (App. A, *infra*, 13a). The CCPA instead considered the "claims, *as a whole*" (App. A, *infra*, 13a-14a, 15a) (emphasis in original) and found that they recite "a process or method for molding rubber articles" (App. A, *infra*, 15a), at whose "heart" is a molding press, not an equation or method of calculation (App. A, *infra*, 16a). Since this "process" constituted "an improvement over prior processes" (App. A, *infra*, 15a) themselves patentable subject matter, the court below concluded that Diehr's "process" was likewise patentable (App. A, *infra*, 15a-18a).

REASONS FOR GRANTING THE PETITION

For the second time in as many months the Court of Customs and Patent Appeals has refused to apply the analysis of patent claims required under *Parker* v. *Flook*, 437 U.S. 584 (1978). This decision and that in *In re Bradley*, 600 F.2d 807 (C.C.P.A. 1979) bring into serious question that court's willingness to abide by this Court's decisions. See also *In re Bergy*, 596 F.2d 952, 966 (C.C.P.A. 1979), cert. granted, No. 79-136 (Oct. 29, 1979); and a very recent third instance, *In re Sherwood*, No. 79-579 (C.C.P.A. Jan. 10, 1980). Since the CCPA's failure

to follow *Flook* is an error also raised in our petition for certiorari in *Diamond* v. *Bradley*, No. 79-855, we suggest that this Court consider this case with *Bradley*.[3]

The facts of this case are remarkably similar to those of *Parker* v. *Flook*, *supra*. The patent application in *Flook* described a three-step method for a computer to update alarm limits in catalytic conversion processes. The steps were: (1) measurement of the present value of the process variable, for example, temperature; (2) use of a mathematical formula in a computer program to calculate an updated alarm-limit value; and (3) actual adjustment of the alarm limit to the updated value. 437 U.S. at 585-586. The present application also describes a three-step method for computer operation of an industrial process—this time in the curing of rubber. The steps are: (1) measurement of the present value of the process variable, temperature; (2) use of a mathematical formula in a computer program to calculate an updated cure time;[4] and (3) direction of the mold presses to open in accordance with the updated cure time.

Perceiving the similarity of the two cases, the Board of Appeals held that the analysis of the claim which this Court performed in *Flook* was also re-

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[3] We have sent respondents a copy of our petition in *Bradley;* we are sending respondents in *Bradley* a copy of this petition.

[4] The underlying mathematical formula here, the Arrhenius equation, is old in the art, while the underlying formula in *Flook* was novel.

quired here. It thus identified and put aside the computer implemented algorithm in the claims and considered whether what remains is old in the art. Compare 437 U.S. at 594 with App. C, *infra*, 22a-25a. It found that everything in Diehr's claim except that algorithm was "conventional" (App. C, *infra*, 24a). It concluded that Diehr was attempting to patent an unpatentable algorithm embodied in a computer program (App. C, *infra*, 23a, 24a).

The Court of Customs and Patent Appeals acknowledged that the claim encompassed a mathematical algorithm (App. A, *infra*, 14a). Moreover, it did not reverse the Board's factual finding that everything in Diehr's claim except the use of the computer to calculate the cure time was old in the art (App. A, *infra*, 13a).[5] It held, however, that this finding was irrelevant (*ibid.*). The court refused to follow the *Flook* analysis, asserting that this Court never "meant to establish that analysis as a general test" (App. A, *infra*, 14a n.6). Viewing the claims "as a whole", it perceived "a process involving the manipulation of apparatus resulting in the chemical and physical change of starting material"

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[5] Diehr contested the Board's finding that the step of continuously measuring the temperature in the press was not novel (App. C, *infra*, 22a; App. A, *infra*, 13a). The court, while expressing an inclination to agree with Diehr, did not decide the question because it held it irrelevant (App. A, *infra*, 13a, 14a). The Board, however, is correct on this factual issue. The examiner cited (App. D, *infra*, 30a) two patents, Gould and Davis, which anticipate Diehr's idea. See Apps. F and G, *infra*, 64a, 67a-68a, 70a-72a, 73a, 75a-76a, 78a, 80.

whose calculation, unlike Flook's, was "intimately entwined with the rubber molding process recited" (App. A, *infra*, 16a, 17a).

The CCPA's decision emasculates *Flook*. The court simply asserted that the *Flook* analysis can be ignored because it was not meant to have general applicability (App. A, *infra*, 13a-14a n.6). But nothing in *Flook* remotely suggests that this Court intended to limit its reasoning to that one case and its particular algorithm and program. *Flook* provides the method of analysis for the generality of cases involving algorithms or computer programs; while the CCPA may not like the decision (see *In re Bergy*, *supra*, 596 F.2d at 966), it can scarcely avoid it by asserting that this Court's analysis in *Flook* should not be applied in other, similar cases. See also our petition in *Diamond* v. *Bradley*, No. 79-855, at 8-10, 12-13. Indeed, the CCPA's approach would make meaningless this Court's explicit rationale in *Flook* that Congress has yet to decide the "[d]ifficult questions of policy concerning the kinds of [computer] programs that may be appropriate for patent protection and the form and duration of such protection." 437 U.S. at 595.

Had the CCPA followed *Flook*, it would have focused on a critical fact that requires rejection of Diehr's application: everything described in Diehr's claim is old except for the use of a computer to recalculate cure time. His claim amounts at most to providing "a new and presumably better method for calculating" cure times. Compare *Parker* v. *Flook*,

supra, 437 U.S. at 594. But this mathematical algorithm, conventionally embodied in a computer program, is no more patentable than the formula was in *Flook*.[6] It is simply not statutory subject matter. *Parker* v. *Flook*, *supra*, 437 U.S. at 594-595.

CONCLUSION

The petition for a writ of certiorari should be granted.

Respectfully submitted.

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[6] Thus the CCPA's characterization of the claim as "a process involving the manipulation of apparatus" with the algorithm "intimately entwined" in that process (App. A, *infra*, 17a) is without legal significance. The same description could be applied to Flook's claim.

APPENDIX A

UNITED STATES COURT OF CUSTOMS AND PATENT APPEALS

Appeal No. 79-527

IN THE MATTER OF THE APPLICATION OF
JAMES R. DIEHR, II, and THEODORE A. LUTTON

Serial No. 602,463

Decided: August 9, 1979

Before MARKEY, Chief Judge, RICH, BALDWIN, and MILLER, Associate Judges, and COWEN,* Senior Judge.

RICH, Judge.

This appeal is from the decision of the Patent and Trademark Office (PTO) Board of Appeals (board) affirming the rejection of claims 1-11, all claims in appellants' application serial No. 602,463, filed August 6, 1975, entitled "Direct Digital Control of Rubber Molding Presses." [1] The claims have been rejected

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* The Honorable Wilson Cowen, United States Court of Claims, sitting by designation.

[1] This application is a continuation of application serial No. 472,595, filed May 23, 1974, now abandoned, which is a continuation-in-part of application serial No. 401,127, filed September 26, 1973, now abandoned.

under 35 USC 101 as being drawn to nonstatutory subject matter. We reverse.

The Invention

Appellants claim a method for operating molding presses used in the manufacture of rubber articles. More specifically, appellants' method produces molded articles which are properly cured, in that their method insures that the articles remain in the press for a period of time sufficient to insure that they are not overprocessed or underprocessed.

According to appellants' specification, achieving a perfect cure depends upon several factors, including the thickness of the article to be molded, the temperature of the molding press, and the amount of time that the article is allowed to remain in the press. These factors are related by the Arrhenius equation, [2] which appellants acknowledge has always been used to calculate the cure time in rubber molding processes.

From a reading of appellants' specification and their brief before this court, it appears that they characterize their contribution to the art as residing

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[2] The Arrhenius equation is expressed as follows:

$$\ln v = C Z + x$$

wherein ln v is the natural logarithm of v, the total required cure time; C is the activation constant, a unique figure for each batch of each compound being molded, determined in accordance with rheometer measurements of each batch; Z is the temperature in the mold; and x is a constant dependent on the geometry of the particular mold in the press.

A rheometer is an instrument to measure flow of viscous substances.

in the step of repeatedly or constantly measuring the actual temperature in the mold. These temperature measurements are then used to calculate the cure time by repeatedly using the Arrhenius equation to arrive at the actual cure time, rather than by the conventionl method which uses a single calculation using that equation based upon the temperature nominally set by a thermostat which controls the heater in the molding press. The conventional method is inherently inaccurate because the temperature value used in the equation is rarely, if ever, the true temperature in the mold environment.

Claim 1 is representative and reads:

> 1. A method of operating a rubber-molding press for precision molded compounds with the aid of a digital computer, comprising:
>
> providing said computer with a data base for said press including at least,
>
> natural logarithm conversion data (ln),
>
> the activation energy constant (C) unique to each batch of said compound being molded, and
>
> a constant (x) dependent upon the geometry of the particular mold of the press,
>
> initiating an interval timer in said computer upon the closure of the press for monitoring the elapsed time of said closure,
>
> constantly determining the temperature (Z) of the mold at a location closely adjacent to the mold cavity in the press during molding,

constantly providing the computer with the temperature (Z),

repetitively calculating in the computer, at frequent intervals during each cure, the Arrhenius equation for reaction time during the cure, which is

$$\ln v = C Z + x$$

where v is the total required cure time,

repetitively comparing in the computer at said frequent intervals during the cure each said calculation of the total required cure time calculated with the Arrhenius equation and said elapsed time, and

opening the press automatically when a said comparison indicates equivalence.

The other claims are similar. Claim 11 does not recite the use of a computer to do the calculating, but, as we shall explain, we find this fact to be of no moment.

The Rejection

The examiner rejected the claims because he believed that *the only non-conventional claim steps* "define a computer program for taking repeated temperature measurements from the mold and calculating cure time in response to said measurement data." On this basis, he decided that appellants were *claiming* a computer program, "subject matter [to] which the Supreme Court has declined to extend patent protection absent a considered action by Congress."

The board agreed with the examiner. It dismissed appellants' argument that no computer program was

disclosed in the specification, citing an admission to the contrary made by appellants during prosecution.[3] The board was aware of the then newly announced Supreme Court decision in *Parker* v. *Flook*, 437 U.S. 584, 198 USPQ 193 (1978) (hereinafter *Flook*), and made use of it in support of its decision to affirm the rejection.

The board, in its examination of claim 1, perceived the only "non-programming" step to be "constantly determining the temperature (Z) of the mold," and stated that according to appellants' specification, in "Background of the Invention," it was old in the art. The board analyzed the other steps recited in claim

---

[3] Appellants have consistently argued that they have not disclosed a computer program in their specification, but in a preliminary amendment, filed August 6, 1975, with their application, they stated:

> The original affidavit by applicants under Rule 132 disclosed that the flow sheet [Figs. 3A and 3B of the specification] is itself basically a program and that the only difference between the flow sheet as a program and the form taken by the program when it gets into the computer is translation into a suitable computer language * * *.

An affidavit of the applicants, dated July 18, 1975, states:

> THAT the program shown in the flow sheets, Figs. 3A and Fig. 3B, is actually a "program" so far as the programmer is concerned and that to apply the "program" * * * to a computer merely involves translation of the symbolic flow sheet into [a suitable computer language].

Thus, by their own admission, it is clear that appellants have disclosed a computer program. However, this fact, by itself, has no significance in the § 101 inquiry, as we shall explain, infra.

1 as being directed to gathering data for use in the recited formula or as "post solution activity," which, according to *Flook*, would not render the claims statutory. The board concluded that appellants' system involves an algorithm solving a mathematical problem in the sense involved in *Flook*.

After similarly analyzing the remainder of the appealed claims, the board concluded as follows:

> It is our view that the only difference between the conventional methods of operating a molding press and that claimed in appellants' application rests in those steps of the claims which relate to the calculation incident to the solution of the mathematical problem or formula used to control the mold heater and the automatic opening of the press.
>
> We think that *appellants' contribution, regardless of claim format*, is a computer program of the character which the USSC has indicated, in both Flook and Benson,[4] is outside the bounds of 35 USC 101. [Emphasis ours.]

Appellants' Arguments

Appellants argue that they have *claimed a process* which is basically chemical and physical in nature, not a computer program or the type of mathematical algorithm involved in *Flook*. They do, however, as they must, acknowledge that calculations according to a recited formula are explicitly *involved in* the claimed process.

---

[4] *Gottschalk* v. *Benson*, 409 U.S. 63, 175 USPQ 673 (1972).

They strenuously take issue with the factual conclusion made by both the examiner and the board that their step of continuously measuring the temperature in the mold cavity is old in the art. They attribute this error to a misreading of their specification and assert that they are the first to employ this step in the molding process.

Appellants also say that the PTO has erred by dissecting their claims into what the PTO considers to be novel and nonnovel elements in order to wrongfully conclude that they are claiming a computer program. They assert that the Supreme Court has never placed a blanket prohibition on the patenting of computer programs and, consequently, that the labeling of an invention as a computer program is not a proper method by which to reject a claim under § 101.

Finally, they argue that there is no prohibition on the patenting of all inventions which involve the use of a computer and that their invention, while it does involve the use of a mathematical formula, does not claim the mathematical formula in a nonstatutory manner. They say that their claims, as entireties, do not define methods of solving a mathematical problem and are statutory under this court's test applied in *In re Johnson*, 589 F.2d 1070, 200 USPQ 199 (CCPA 1978).

OPINION

A claim drawn to a process or method does not depend for its validity under 35 USC 101 on whether a computer is involved. If the claim is drawn to sub-

ject matter, *which is otherwise statutory*, it does not become nonstatutory merely because a computer is involved in its execution. Thus, the fact that it may be said that an invention is drawn to a computer program or involves a computer is an observation which does nothing to aid in the determination of compliance with § 101. *In re Gelnovatch*, 595 F.2d 32, 36-37, 201 USPQ 136, 141 (CCPA 1979); *In re Johnson*, 589 F.2d 1070, 1081, 200 USPQ 199, 210-11 (CCPA 1978); *In re Chatfield*, 545 F.2d 152, 155, 191 USPQ 730, 733 (CCPA 1976). Therefore, any rejection which is based solely on the determination that a computer or computer program is involved is insupportable because it is overly broad and must be reversed as being without basis in the law.

The Supreme Court, in the two instances in which it has addressed itself to the § 101 issue in cases where computer-related inventions are involved, has not said anything to the contrary. Our view is not in any way inconsistent with these precedents.

In *Gottschalk* v. *Benson*, supra n. 4 (hereinafter *Benson*), the Court addressed a claimed method for converting binary coded decimal (BCD) numbers to equivalent pure binary numbers. The Court observed that the claims were "not limited to any particular art or technology, to any particular apparatus or machinery, or to any particular end use. They purported to cover any use of the claimed method in a general-purpose digital computer of any type." 409 U.S. at 64, 175 USPQ at 674. The court determined that the claimed method was a mathematical algo-

rithm, i.e., a "procedure for solving a given type of mathematical problem," and further, that "The mathematical procedures can be carried out in existing computers long in use, no new machinery being necessary. And, as noted, they can also be performed without a computer." *Id.* at 65, 67, 175 USPQ at 674, 675.

The Court reviewed long-standing precedent to the effect that while an abstract principle or idea, or a scientific truth, or its equivalent mathematical expression is nonstatutory, an invention created from the *application* of such a truth or useful *structure* created therefrom is statutory.

The Court then proceeded to hold Benson's invention to be nonstatutory with the following statements (*Id.* at 71-72, 175 USPQ at 676, emphasis ours):

> We do not hold that no process patent could ever qualify if it did not meet the requirements of our prior precedents. *It is said that the decision precludes a patent for any program servicing a computer. We do not so hold.* It is said that we have before us a program for a digital computer but extend our holding to programs for analog computers. We have, however, made clear from the start that we deal with a program only for digital computers. It is said we freeze *process patents* to old technologies, leaving no room for the revelations of the new, onrushing technology. *Such is not our purpose.* What we come down to in a nutshell is the following.
>
> *It is conceded that one may not patent an idea. But in practical effect that would be the result*

if the formula for converting BCD numerals to pure binary numerals were patented in this case. The mathematical formula involved here has no substantial practical application except in connection with a digital computer, which means that if the judgment below is affirmed, the patent would wholly pre-empt the mathematical formula and in practical effect would be a patent on the algorithm itself.

From the Court's holding itself, as well as from its discussion of the applicable legal principles, it is clear that the claims were held to be fatally deficient under § 101, *not because a computer program was being claimed,* but because a *mathematical formula* or algorithm per se was being claimed. Important to the Court's reasoning was the fact that the formula involved dealt with the binary radix, or base two number system. The only practical and significant application of the binary system in the real world is in connection with digital computers, which operate in the binary system—a system easily represented electrically by the "on" and "off" or conducting and nonconducting states of the circuit elements comprising the computer. Seen in this light, it is apparent that the claim would, in effect, dominate all practical and significant uses of the formula. Thus, the Court viewed the claim as directed to the scientific truth itself, rather than to an *application* of, or *structure* created with the aid of, the scientific truth. This belies any notion that the claims were held to be nonstatutory because drawn to a computer program per se.

Parker v. *Flook*, supra, presented the Supreme Court with a similar situation. The claims were drawn to a method for updating an alarm limit used in petroleum refining processes. The Court determined that the claims were essentially directed to the use of a new *mathematical formula* in the conventional process of updating alarm limits. According to the majority, "Respondent's application [sic, claimed invention] simply provides a new and presumably better method for calculating alarm limit values." 437 U.S. at 594-95, 198 USPQ at 199 (emphasis ours). As in *Benson*, the Court in *Flook* was simply saying that the claims were an attempt to patent *the scientific truth itself*, rather than an application of the truth or a structure created by its use." "[I]f a claim is directed essentially to a method of calculating, using a mathematical formula, even if the solution is for a specific purpose, the claimed method is nonstatutory." 437 U.S. at 595, 198 USPQ at 199, *quoting In re Richman*, 563 F.2d 1026, 1030, 195 USPQ 340, 343 (CCPA 1977).

The Court's holding in *Flook* was "very simply" stated: "[O]ur holding today is that a claim for an improved *method of calculation*, even when tied to a specific end use, is unpatentable subject matter under § 101." *Id.* n. 18. (Emphasis ours.) As in *Benson*, this holding has nothing to do with computers or computer programs per se.

This, as we perceive it, is the direction which has been given us by the Supreme Court. Until the Court directs us otherwise, we continue to disagree with the

notion that a claim may be rejected as nonstatutory merely because it *involves* a computer program or is computer-related. As far as we are concerned, claims may be rejected under § 101 because they attempt to embrace *only* a mathematical formula, mathematical algorithm, or method of calculation, but not merely because they define inventions having something to do with a computer.

In view of the foregoing, to the extent that the examiner's position is based upon the mere alleged presence of a computer program in appellants' claims, it is without basis in the law and cannot be sustained. The Board, however, in addition to stating the inadequate reason that a computer program is involved, analyzed the claims to determine what steps in the process were old or conventional and apparently ignored such steps, confining its consideration to the nature of what it deemed to be "appellants' contribution." It then found that contribution to be a "computer program" relating to a calculation incident to the solution of a mathematical problem or formula used to control the opening of the press, and, for that reason, held the claims to be drawn to nonstatutory subject matter under *Flook* and *Benson*. We wish to make clear that this analysis is the only basis upon which we are reviewing the rejection, and that, but for this reasoning, we would be constrained to summarily reverse or remand this case to the board for an adequate analysis. *See In re Phillips*, 593 F.2d 1021, 201 USPQ 257 (CCPA 1979).

Appellants and the PTO have locked horns over whether the step of continually measuring the temperature in the mold cavity is old in the art. While we are inclined to agree with appellants that the record is devoid of any evidence that *this step* was ever performed by persons other than appellants,[5] we fail to see what relevance this issue has to the § 101 inquiry. Considerations of novelty and obviousness have no bearing on compliance with § 101. *In re Bergy*, 596 F.2d 952, 960-61, 962-63, 201 USPQ 352, 361, 362 (CCPA 1979); *Nickola* v. *Peterson*, 580 F.2d 898, 906-907, 198 USPQ 385, 395-96 (6th Cir. 1978). Thus, the fact that certain limitations in a claim may be novel and certain others may be old is irrelevant to the outcome of this case.[6] The focus of

---

[5] The fact that a thermostat has been used to control the mold heater does not mean that the mold temperature has been continually *measured*. A thermostat reacts to only one temperature—the one to which it has been set. It is incapable of discretely recognizing the existence of any other definite temperature, and, hence, is incapable of *continually measuring* the temperature of the environment in which it has been placed; it merely knows whether the actual temperature is above or below the set point. This can hardly be called temperature *measurement*.

[6] Although in *Flook* the Supreme Court assumed the equation of the claim to be old in the art even though it was not, the holding of that case does not depend on that mode of analysis. Since Flook's claims were held to be directed to methods of calculation, they were nonstatutory *regardless* of whether the equation was new or old. While the Supreme Court in that case may have found that analysis a convenient vehicle to highlight the fact that Flook's actual contribution to the useful arts was his new formula, we do not believe the

the inquiry should be whether the claim, *as a whole*, is directed essentially to a method of calculation or mathematical formula. No one step or subgroup of steps determines whether the entire claim defines statutory subject matter. *Flook*, 437 U.S. at 594 n. 16, 198 USPQ at 199 n. 16; *In re Chatfield*, 545 F.2d at 158, 191 USPQ at 738. We are concerned only with what *entire* claims define and with whether that falls within § 101.

We turn now to a consideration of the claims on appeal. Appellants attach significance to the fact that claim 11, unlike the remaining claims, does not anywhere recite a computer. In light of our foregoing discussion regarding § 101, we do not find either the presence or absence of computer-related recitations in a claim to be of any significance. If the claim is drawn to a mathematical algorithm, formula, or method of calculation, it is nonstatutory whether it recites that a computer, an abacus, or a pencil and paper are used to make the calculations. The statutory nature of a process or method does not depend, under § 101, on the means used to carry it out. *In re Gelnovatch*, supra, *In re Johnson*, supra.

Since the claims before us directly recite a mathematical formula, namely, the Arrhenius equation, they must be subjected to further scrutiny. The mere presence of a mathematical formula in a claim is not a prima facie ground for holding that claim

---

Court meant to establish that analysis as a general test in determining compliance with § 101, especially when indiscriminately applied to claim limitations generally.

to be nonstatutory, *Flook*, 437 U.S. at 590, 198 USPQ at 197; *In re Johnson*, 589 F.2d at 1076 n. 5, 200 USPQ at 206 n. 5, but, for the claim to be statutory, there must be some substance to it other than the recitation and solution of the equation or formula. The formula, as an embodiment of a scientific principle, must be applied in some useful manner in a method or process, *see, e.g., Tilghman* v. *Proctor*, 102 U.S. 707 (1880) (scientific fact or principle, of which a mathematical formula is one example, used in a chemical process), or be embodied in the design of some useful structure, machine or apparatus, *see, e.g., Eibel Process Co.* v. *Minnesota and Ontario Paper Co.*, 261 U.S. 45 (1923) (law of gravity, expressible in mathematical terms, used in design of a paper-making machine).

This court has formulated a two-step test to determine compliance with § 101 of a claim involving mathematics. *In re Freeman*, 573 F.2d 1237, 1245, 197 USPQ 464, 471 (CCPA 1978). Since, under the first step of the test, the determination that the claim involves mathematical calculations has already been made, we proceed to the second step of the test to determine "whether the claim merely recites a mathematical formula or a method of calculation as in *Benson* and *Flook*." *In re Johnson*, 589 F.2d at 1077, 200 USPQ at 207. We conclude that it does not.

Each of appellants' claims, *as a whole*, recites a process or method for molding rubber articles. They are an improvement over prior processes in that appellants provide for opening the mold at precisely

the correct time rather than at a time which has been determined by approximation or guesswork. It is this feature of the process that *involves* the Arrhenius equation. The recitation of the equation is not separable from the process in which it is used; it is intimately involved in the process, but the claims are not to the equation. We find these claims to be directly comparable to those involved in *Tilghman* v. *Proctor*, supra, and *Eibel Process Co.* v. *Minnesota and Ontario Paper Co.*, supra, in that they involve the employment of a scientific truth to a new and useful end without attempting to control the use of the truth itself. As Mr. Justice Stone, writing for the Court in *Mackay Radio and Telegraph Co.* v. *Radio Corporation of America*, 306 U.S. 86 (1939), stated (306 U.S. at 94):

> While a scientific truth, or the mathematical expression of it, is not patentable invention, a novel and useful structure created with the aid of knowledge of scientific truth may be.

Though he spoke of "structure" the same is true of a process and the reasoning applies with equal force. The claims here at issue are not, as the PTO asserts, directed to an improved method of calculation for the cure time of rubber articles; such a conclusion is only made possible by ignoring the fact that a molding press is recited and operates as the heart of the process. The PTO has separated the claim into old and new elements, ignoring the presence of the old elements in its analysis. Such reasoning is impermissible. The novelty or otherwise of any element

or even of all the elements or steps, or of the combination has no bearing on whether the process is encompassed by § 101.

The claims here on appeal are fundamentally different from the claims involved in *Flook*. They recite a process involving the manipulation of apparatus resulting in the chemical and physical change of starting material, the time that the mold remains closed being controlled by a series of calculations using a recited formula. *See In re Deutsch*, 553 F.2d 689, 193 USPQ 645 (CCPA 1977) (claimed methods of operating an entire manufacturing plant system using particular algorithms); *In re Chatfield*, supra (claimed methods of operating machines in a more efficient manner using particular algorithms). It would be a gross distortion to say that the claims on appeal are directed essentially to calculations. In *Flook*, by contrast, the claims recite nothing but the calculation, coupled with the post-solution activity consisting only of updating an alarm limit to the newly-calculated value which is merely a new number. Here, the calculation is intimately entwined with the rubber molding process recited. Therefore appellants are not claiming a process for merely generating a new number by a calculation.

Stated as a general proposition, "regardless of claim format" as the board said, one would hardly question that a rubber-molding process falls within the § 101 categories of possibly patentable subject matter, and that is what is claimed. We see no reason why particularizing in claims a more precise

way of timing the molding cycle should remove them from the "process" category of § 101. The board erred in ignoring all of the old or conventional steps in the claims. Novelty considerations have no bearing on whether claims define statutory subject matter under § 101.

The decision of the board is *reversed.*

REVERSED

APPENDIX B

UNITED STATES COURT OF CUSTOMS AND PATENT APPEALS

MANDATE

No. 79-527

IN THE MATTER OF THE APPLICATION OF
JAMES R. DIEHR, II and THEODORE A. LUTTON

Serial No. 602,463

ON APPEAL FROM THE BOARD OF APPEALS

This CAUSE having been heard and considered, it is

ORDERED and ADJUDGED: Reversed.

DATED August 9, 1979
Petition for rehearing denied; October 18, 1979.

A TRUE COPY

TEST:

GEORGE E. HUTCHINSON
Clerk
United States Court
of Customs and
Patent Appeals

Certified this 25th day of
October 1979

By /s/ George E. Hutchinson

[SEAL]

APPENDIX C

OPINION AND DECISION OF BOARD OF APPEALS, AUGUST 18, 1978

Before Burns and Spencer, Examiners-in-Chief, and Craig, Acting Examiner-in-Chief.

Burns, Examiner-in-Chief.

This is an appeal from the final rejection of claims 1 through 11, constituting all of the claims presently in the case. Disclosure is directed to a method of operating a rubber-molding press, best understood from a consideration of representative claim 1:

> 1. A method of operating a rubber-molding press for precision molded compounds with the aid of a digital computer, comprising:
>
> providing said computer with a data base for said press including at least,
>
> natural logarithm conversion data (ln),
>
> the activation energy constant (C) unique to each batch of said compound being molded, and
>
> a constant (x) dependent upon the geometry of the particular mold of the press,
>
> initiating an interval timer in said computer upon the closure of the press for monitoring the elapsed time of said closure,
>
> constantly determining the temperature (Z) of the mold at a location closely adjacent to the mold cavity in the press during molding,
>
> constantly providing the computer with the temperature (Z),

repetitively calculating in the computer, at frequent intervals during each cure, the Arrhenius equation for reaction time during the cure, which is

$$\ln v = C Z + x$$

where v is the total required cure time,

repetitively comparing in the computer at said frequent intervals during the cure each said calculation of the total required cure time calculated with the Arrhenius equation and aid elapsed time, and

opening the press automatically when a said comparison indicates equivalence.

A single rejection has been lodged against the claims under 35 U.S.C. 101, the examiner maintaining that the claims are directed to non-statutory subject matter. We have reviewed the arguments advanced by appellants in their brief and reply brief, together with the statement of the rejection and response provided by the examiner in his final rejection and answer. We agree with the examiner.

Beginning on page 22 of their brief, appellants urge that their application does not disclose a computer program and that, thus, they could not claim one. They point to the several preambles of the independent claims 1, 5, 7 and 11. While we might agree that appellants have provided no program listing as part of their disclosure, we would observe that there are many ways in which a program may be disclosed. Figures 3-A and 3-B, with the attendant textual description on pages 9-13 of the specifica-

tion, are, we think, an appropriate description of a program sufficient for the person of ordinary skill in the art to create the machine readable program code acceptable to the computer. This appears to be substantiated by the affidavit of Ekland submitted by appellants, and we note that no rejection under 35 U.S.C. 112, paragraph 1, as to insufficiency of the disclosure has been urged by the examiner.

We have reviewed the cases cited by appellants, in particular *Gottschalk* v. *Benson et al.*, 409 US 63, 175 USPQ 673 (1972), hereinafter Benson, and *In re Christensen*, 478 F.2d 1392, 178 USPQ 35 (CCPA, 1973). We have also had available for consideration the newly decided case by the USSC, *Parker* v. *Flook*, 437 US . . . ., 198 USPQ 193 (1978), hereinafter Flook.

Turning to the claims, we agree with appellants that steps are included which are not part of a computer program. We take exception, however, to appellants' arguments on pages 28 and 29 of the brief as to what constitutes part of a computer program.

In claim 1, the only non-programming step which we perceive is:

> "constantly determining the temperature (Z) of the mold . . .".

This step, we note, appears to be within the prior art as described in "Background of the Invention", specification pages 1-3.

Steps found in the prior art such as these will not lift the Benson/Flook proscription, *In re* Christensen,

supra; In re Chatfield, 545 F.2d 152, 191 USPQ 730 (CCPA, 1976); and *In re Richman*, 563 F.2d 1026, 195 USPQ 341 (CCPA, 1977).

The step of "opening the press automatically . . ." appears to fall in the post-solution category which will not render the claims statutory, see Flook. We would add that proper execution of such a step requires the appropriate program instructions in the recited preceding steps, and thus may be considered as program dependent.

Steps, such as those of claim 1, which provide the computer with data base or with signals representing parameters sensed, such as:

> "constantly providing . . . (Z)", or
> "initiating an interval timer in said computer . . .",

all require instructions written into the program without which the computer will not accept data or initiate any of its internal timers.

That appellants' system performs operations involving an algorithm, solving a mathematical problem, as addressed in Benson and Flook, is apparent, see for example claim 1 "repetitively calculating . . ." and "repetitively comparing . . ."

In claims 2 and 8, "measuring . . ." appears to be a non-programming step, but of the data gathering category, while "automatically updating said data base . . ." clearly requires the presence of program instructions.

In claims 3, 4, 9 and 10, the first three steps, namely," providing . . .", "calculating . . .", and "comparing . . ." require programming instructions.

The step of "controlling . . .", found in claims 3 and 9, is post-solution in character and is subject to our remarks above.

As for claims 5 and 6, all of the steps require program instructions.

With regard to claim 7:

"installing . . .",

"closing said press . . .",

"constantly determining the temperature . . .",

"opening the press . . .", and

"removing . . . article",

all appear to be conventional steps known in the art. The remainder of the steps in this claim are directed to the computer program.

In claim 11, steps (a), (b), (c), (e), (f), (i) and (j) appear to be conventional molding process steps, while steps (d), (g) and (h) set forth the program.

It is our view that the only difference between the conventional methods of operating a molding press and that claimed in appellants' application rests in those steps of the claims which relate to the calculation incident to the solution of the mathematical problem or formula used to control the mold heater and the automatic opening of the press.

We think that appellants' contribution, regardless of claim format, is a computer program of the character which the USSC has indicated, in both Flook and Benson, is outside the bounds of 35 U.S.C. 101.

We have had occasion to make reference, severally, to the steps of the claims which represent prior art,

and also to the steps which constitute the computer program. In so doing however, we do not consider that we have in any way dissected the claim. Discussion of the various features or components of the claims would not appear to be inconsistent with the view that a patent claim must be considered as a whole, see Flook. We will sustain the rejection.

The decision of the examiner is affirmed.

AFFIRMED

WALTER W. BURNS, JR.
Examiner-in-Chief

RICHARD A. SPENCER
Examiner-in-Chief

JERRY D. CRAIG
Examiner-in-Chief
(Acting)

BOARD OF APPEALS

APPENDIX D

U.S. DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

Paper No. 7

Ruggiero 236
08/06/75 602,463
James R. Dierh II, et al

Robert E. Wickersham
Owen, Wickersahm, et al
433 Calif. St., 11th Floor
San Francisco, Calif. 94104

Mailed 1-26-76

This is a communication from the Examiner in charge of your application.

Commissioner of Patents and Trademarks

☑ This application has been examined.

☐ Responsive to communication filed _____ ☐ This action is made final.

A SHORTENED STATUTORY PERIOD FOR RESPONSE TO THIS ACTION IS SET TO EXPIRE 3 MONTH(S) ____ DAYS FROM THE DATE OF THIS LETTER.

PART I

The following attachments(s) are part of this action:

a. ☑ Notice of References Cited, Form PTO-892. b. ☐ Notice of Informal Patent Drawing, PTO-948.

c. ☐ Notice of Informal Patent Application, Form PTO-152. d. ☐

PART II

Summary of Action

1. ☑ Claims 1-10 are presented for examination.
2. ☐ Claims _____ are allowed.
3. ☐ Claims _____ would be allowable if amended as indicated.
4. ☑ Claims 1-10 are rejected.
5. ☐ Claims _____ are objected to.
6. ☐ Claims _____ are subject to restriction or election requirement.
7. ☐ Claims _____ are withdrawn from consideration.
8. ☐ Since this application appears to be in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under Ex parte Quayle, 1935 C.D. 11; 453 OG. 213
9. ☐ Since it appears that a discussion with applicant's representative may result in agreements whereby the application may be placed in condition for allowance, the examiner will telephone the representative within about 2 weeks from the date of this letter.
10. ☐ Receipt is acknowledged of papers under 35 USC 119, which papers have been placed of record in the file.
11. ☐ Applicant's claim for priority based on an application filed in _____ on _____ is acknowledged. It is noted, however, that a certified copy as required by 35 USC 119 has not been received.
12. ☐ Other

PTOL 326 (7/73)

1. This application has been examined and this action is responsive to applicant's preliminary amendment filed along with the application.

2. The specification is objected to as containing insufficient disclosure under 35 USC 112. The instant invention is disclosed and claimed to be one involving a general purpose digital computer properly programmed to calculate the correct cure time for a rubber-molding press and to open such press accordingly. A general purpose computer by itself would be incapable of carrying out any operation until its sequence of internal interconnections has been added thereto by the preparation and loading of a program into the internal memory of the computer. The instant disclosure does not identify any program which will cause the computer to carry out the necessary functions. Although applicants have provided a flow chart, it is noted that such flow chart is not a program and only suggests operations from the point of view of desired results.

3. Claims 1-10 are now in this case.

4. Claims 1-10 are rejected as being drawn to insufficient disclosure as discussed in paragraph 2, above.

5. Claims 1-10 are further rejected under 35 USC 101 as being drawn to non-statutory subject matter. Claims 1-6 recite a series of steps for operating a rubber molding press in conjunction with a digital computer. A close inspection of the claims reveals that all of the claimed method steps involve either

the inputting of data *to* the computer, the operation of the computer on such data, and the provision of an output signal by the computer in response to such operation. All of these steps are carried out by the computer under control of a stored program. New claims 7-10 recite the additional "physical" steps of installing rubber in the press and the subsequent closing of the press; however, these steps are conventional and necessary to the process and cannot be the basis of patentability. It remains the Examiner's position therefore, that applicants' claims define and seek protection on a computer program for operating a rubber molding press. Such has been held to be non-statutory subject matter by the Supreme Court in Gottschalk v. Benson, 175 USPQ 673.

6. Applicants' arguments have been considered but are not convincing to overcome the above rejections. In patent application S. N. 472,595, applicants submitted a Rule 132 affidavit which detailed a factory installation of the invention involving 60 presses and concluded that the time required to achieve production would be 7 months. In response to the Examiner's position that such a time span for implementation of the invention was outside the bounds of "undue experimentation", the applicants have filed an additional Rule 132 affidavit. This affidavit includes an estimate of a 6 man week time span for implementation of the invention if only a single press were involved. However, it must be pointed out that such an estimate is merely an opinion and few if any facts have been presented to support such a con-

clusion. The Examiner remains of the position that such evidence is not sufficient to overcome the rejection on insufficient disclosure.

7. Patents A-E are cited of interest but are not applied against the claims.

/s/ Joseph F. Ruggiero
JOSEPH F. RUGGIERO
Examiner
Group Art Unit 236

Ruggiero/dmcb
557-2871
12/2/75

FORM PO-892 (REV. 2-72) U.S. DEPARTMENT OF COMMERCE PATENT OFFICE

SERIAL NUMBER	GROUP ART UNIT	ATTACHMENT TO PAPER NUMBER
472595	236	

NOTICE OF REFERENCES CITED

☐ Check here if this is a supplemental citation. (Do not prepare an additional folder.)

APPLICANT(S): J. R. DIEHR ET AL

U.S. PATENTS

*		PATENT NO.	DATE	PATENTEE	CLASS	SUB-CLASS	FILING DATE IF APPROPRIATE
	A	3659974	5-1972	NEUGROSCHL	264	40 X	
	B	3721721	2-1973	GOULD ET AL	264	40	
	C	3819915	6-1974	SMITH	235	151 X	8-17-1971
	D	3579626	5-1971	BRITTAIN	264	315 X	
	E	3649729	3-1972	DAVIS ET AL	264	40	
	F						
	G						
	H						
	I						
	J						
	K						

FOREIGN PATENTS OR PUBLISHED APPLICATIONS

*		PATENT NO.	DATE	COUNTRY	NAME	CLASS	SUB-CLASS	PERTINENT SHTS. DWG	PERTINENT PP. SPEC.
	L								
	M								
	N								
	O								
	P								
	Q								

OTHER REFERENCES (Including Author, Title, Date, Pertinent Pages, Etc.)

*		
	R	
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EXAMINER	DATE	
RUGGIERO	11-18-1975	☐ CHECK HERE IF FOREIGN EXCHANGE

* ATTENTION R.P.S.: Do not furnish copy if this box is checked.

USCOMM-DC 50880-P71

LETTER OF EXAMINER, JANUARY 26, 1976

[X] This application has been examined.
[ ] Responsive to communication filed .....
[ ] This action is *made final.*

A SHORTENED STATUTORY PERIOD FOR RESPONSE TO THIS ACTION IS SET TO EXPIRE 3 MONTHS(S) ..... DAYS FROM THE DATE OF THIS LETTER.

PART I

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a. [X] Notice of References Cited, Form PTO-892.
b. [ ] Notice of Informal Patent Drawing, PTO-948.
c. [ ] Notice of Informal Patent Application, Form PTO-152.
d. [ ]

PART II

Summary of Action

1. [X] Claims 1-10 are presented for examination.
2. [ ] Claims ..... are allowed.
3. [ ] Claims ..... would be allowable if amended as indicated.
4. [X] Claims 1-10 are rejected.
5. [ ] Claims ..... are objected to.
6. [ ] Claims ..... are subject to restriction or election requirement.
7. [ ] Claims ..... are withdrawn from consideration.

8. [ ] Since this application appears to be in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under Ex parte Quayle, 1935 C.D. 11; 453 OG. 213.

9. [ ] Since it appears that a discussion with applicant's representative may result in agreements whereby the application may be placed in condition for allowance, the examiner will telephone the representative within about 2 weeks from the date of this letter.

10. [ ] Receipt is acknowledged of papers under 35 USC 119, which papers have been placed of record in the file.

11. [ ] Applicant's claim for priority based on an application filed in ..... on ..... is acknowledged. It is noted, however, that a certified copy as required by 35 USC 119 has not been received.

12. [ ] Other

1. This application has been examined and this action is responsive to applicant's preliminary amendment filed along with the application.

2. The specification is objected to as containing insufficient disclosure under 35 USC 112. The instant invention is disclosed and claimed to be one involving a general purpose digital computer properly programmed to calculate the correct cure time for a rubber-molding press and to open such press accordingly. A general purpose computer by itself would be incapable of carrying out any operation until its sequence of internal interconnections has been added

thereto by the preparation and loading of a program into the internal memory of the computer. The instant disclosure does not identify any program which will cause the computer to carry out the necessary functions. Although applicants have provided a flow chart, it is noted that such flow chart is not a program and only suggests operations from the point of view of desired results.

3. Claims 1-10 are now in this case.

4. Claims 1-10 are rejected as being drawn to insufficient disclosure as discussed in paragraph 2, above.

5. Claims 1-10 are further rejected under 35 USC 101 as being drawn to non-statutory subject matter. Claims 1-6 recite a series of steps for operating a rubber molding press in conjunction with a digital computer. A close inspection of the claims reveals that all of the claimed method steps involve either the inputting of data *to* the computer, the operation of the computer on such data, and the provision of an output signal by the computer in response to such operation. All of these steps are carried out by the computer under control of a stored program. New claims 7-10 recite the additional "physical" steps of installing rubber in the press and the subsequent closing of the press; however, these steps are conventional and necessary to the process and cannot be the basis of patentability. It remains the Examiner's position therefore, that applicants' claims define and seek protection on a computer program for operating a rubber molding press. Such has been held to be

non-statutory subject matter by the Supreme Court in Gottschalk v. Benson, 175 USPQ 673.

6. Applicants' arguments have been considered but are not convincing to overcome the above rejections. In patent application S. N. 472,595, applicants submitted a Rule 132 affidavit which detailed a factory installation of the invention involving 60 presses and concluded that the time required to achieve production would be 7 months. In response to the Examiner's position that such a time span for implementation of the invention was outside the bounds of "undue experimentation", the applicants have filed an additional Rule 132 affidavit. This affidavit includes an estimate of a 6 man week time span for implementation of the invention if only a single press were involved. However, it must be pointed out that such an estimate is merely an opinion and few if any facts have been presented to support such a conclusion. The Examiner remains of the position that such evidence is not sufficient to overcome the rejection on insufficient disclosure.

7. Patents A-E are cited of interest but are not applied against the claims.

JOSEPH F. RUGGIERO
Joseph F. Ruggiero
Examiner
Group Art Unit 236

LETTER OF EXAMINER, JULY 8, 1976

[X] This application has been examined.

[X] Responsive to communication filed April 21, 1976.

[X] This action is *made final.*

A SHORTENED STATUTORY PERIOD FOR RESPONSE TO THIS ACTION IS SET TO EXPIRE 3 MONTH(S) . . . . DAYS FROM THE DATE OF THIS LETTER.

PART I

The following attachment(s) are part of this action:

a. [ ] Notice of References Cited, Form PTO-892.

b. [ ] Notice of Informal Patent Drawing, PTO-948.

c. [ ] Notice of Informal Patent Application, Form PTO-152.

d. [ ]

PART II

Summary of Action

1. [X] Claims 1-11 are presented for examination.

2. [ ] Claims ..... are allowed.

3. [ ] Claims ..... would be allowable if amended as indicated.

4. [X] Claims 1-11 are rejected.

5. [ ] Claims ..... are objected to.

6. [ ] Claims ..... are subject to restriction or election requirement.

7. [ ] Claims ..... are withdrawn from consideration.

8. [ ] Since this application appears to be in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under Ex parte Quayle, 1935 C.D. 11; 453 OG. 213.

9. [ ] Since it appears that a discussion with applicant's representative may result in agreements whereby the application may be placed in condition for allowance, the examiner will telephone the representative within about 2 weeks from the date of this letter.

10. [ ] Receipt is acknowledged of papers under 35 USC 119, which papers have been placed of record in the file.

11. [ ] Applicant's claim for priority based on an application filed in ..... on ..... is acknowledged. It is noted, however, that a certified copy as required by 35 USC 119 has not been received.

12. [ ] Other

1. This action is responsive to applicant's communication filed April 21, 1976.

2. Claims 1-11 are now in this case.

3. Claims 1-11 are rejected under 35 USC 101 as being drawn to non-statutory subject matter as discussed in paragraph 5, paper no. 2. New claim 11 is subject to the same deficiencies as claims 7-10 in that the so-called "physical" steps such as heating the

mold, closing the press, heating the mold and opening the press are conventional and necessary to the process and cannot be the basis for patentability.

4. Applicant's arguments have been considered but are not convincing. As applicants correctly state, the Supreme Court in the case of Dann v. Johnston, decided the case on the issue of obviousness under 35 USC 103 and did not discuss the issue raised by 35 USC 101. However, the Examiner cannot agree with applicant's conclusion that such action results in an implication that the Court was somehow acquiescing in the CCPA position on 35 USC 101. The Supreme Court's decision was actually a reversal of the CCPA decision which leaves standing the Board of Appeals decision regarding the patentability of the claims, i.e. that the claims are not patentable.

5. This action is made FINAL.

JOSEPH F. RUGGIERO
Joseph F. Ruggiero
Examiner
Group Art Unit 236

APPENDIX E

APPLICATION OF JAMES R. DIEHR, II AND THEODORE A. LUTTON, FILED AUGUST 6, 1975, SERIAL NUMBER 602,463, FOR DIRECT DIGITAL CONTROL OF RUBBER MOLDING PRESSES

Abstract of the Disclosure

Rubber-molding presses, which are closed manually upon installation of pieces of rubber compound, are opened automatically by a system which continuously calculates and recalculates the correct cure time and is actuated when the calculated cure time equals the elapsed cure time. An interval timer starts running from the time of mold closure, and the temperature within the mold cavity is measured often, typically every ten seconds. The temperature is fed to a computer which also is given access to the time-temperature cure data for the compound being molded, and the computer calculates and recalculates every time the data as to temperature is presented, until the total picture of time and temperature presents to the computer the time at which the material is fully cured. Then the computer signals for automatic opening of the mold press. Many presses can be controlled by a single computer, which still operates to recalculate the data about every ten seconds, and the time-temperature cure data for the compound can also be modified by information from a rheometer.

Cross Reference to Related Application

This application is a continuation-in-part of application Serial No. 401,127, filed September 26, 1973.

Background of the Invention

This invention relates to accurate and automatic control of the molding time for rubber compounds and the automatic opening of rubber-molding presses when the cure is calculated to be complete.

Much time-temperature cure data for rubber compounds is known, and each manufacturer of rubber products usually has some of this material at his disposal. The usual way of operating rubber-molding presses is for the operator to load them manually and for the operator then to close the press. Closure of the press operates a timer which has been preset for a time at which cure should be completed in view of what is supposed to be the temperature of the mold. However, the mold temperature, even though it is thermostatically maintained, is not likely to be identical with this supposed temperature. The actual temperature of the mold may vary rather widely, and the correction of the temperature by the thermostat may take some time. For example, the amount of time that the press is open during the operator's loading of the press varies, and the longer the press is open, the cooler the mold is when it is closed and again starts heating. Thus, it may be many degrees below its nominal temperature when the mold is first closed, and it may take a substantial amount of time

for the mold to reach this nominal temperature. The thermostats are usually actuated within a plus or minus 2% to cause the device to heat until it reaches the nominal temperature, but this is not sufficient to assure that that temperature has been maintained as an average during the entire molding operation—as a matter of fact, it rarely if ever has.

Because of these inaccuracies, the practice in the industry has been to calculate the cure time as the shortest time in which one can be absolutely certain that all parts will be cured with any reasonable amount of mold-opening time during unloading of the previous batch and reloading. This, of course, means that the rubber will tend to be overcured in almost every instance, because the worst cure time will not be so often met with. It also means that if there are times in which the mold is opened longer than was thought or in which the mold temperature for some other reason did not rise in time, that even the nominally worst time will not be so bad that some batches will be undercured.

This practice has had two serious economical effects: in the first place, many batches have to be discarded when after tests they are found either to be undercured or overcured beyond the tolerance limits. This has been a serious problem in many factories where synthetic rubber has been cured. In the second place, it means that the molds are kept occupied and are closed much longer than they need to be to obtain the best results. This means that fewer products can be molded per unit time and per hour of operator

work. As a result, there has been substantially less production than would have been possible had the actual cure time been known and followed by the mold.

It is an object of the present invention to achieve more exact cure of the rubber material being molded so as to substantially reduce the number of defectively cured batches that have to be rejected. Another object is to reduce substantially the amount of time in which the presses are closed unnecessarily. By accurate and constant calculation and recalculation of the correct mold time under the temperatures actually present in the mold, the material can be cured accurately and can be relied upon to produce very few rejections, perhaps completely eliminating all rejections due to faulty mold cure. Furthermore, the mold and the operator can be much more efficiently employed.

Summary of the Invention

The invention uses computers of well-known type with data storage banks containing the time-temperature cure data for the compound or compounds being used; in some cases, the stored data includes additional cure data, such as variations in batch characteristics. A surveillance system is maintained over the mold to determine the actual mold temperature substantially continuously, for example, every ten seconds, and to feed that information to the computer along with the pertinent stored data and along with the elapsed time information. The computer then

continually recalculates on the basis of the temperature changes, and the elapsed time, and the time-temperature cure data, and arrives every ten seconds at a new time-temperature cure curve for that particular batch then being cured which the computer compares with the elapsed time every second; then, when the calculated cure time equals the elapsed cure time, the computer signals the opening of the mold to an electromechanical device which immediately opens the mold.

Modern computers act so rapidly that these recalculations are no burden and can easily be done each second. In fact, a computer can work much faster than that, so that a series of molds can be monitored in the same way with perhaps 50 or 60 molds being watched, and every ten seconds the actual temperature for each mold involved can be fed to the computer, which calculates with the time-temperature data available the correct cure for each and every mold and opens each one separately.

Moreover, further accuracy can be obtained by supplying the computer with rheometer data for each batch of the molding compound so that the computer has even more accurate information that will affect the time-temperature cure data.

Other objects and advantages of the invention will appear from the following description of a preferred embodiment.

Brief Description of the Drawings

In the drawings:

Fig. 1 is a flow sheet for a simple system for controlling a single mold and a single compound and illustrating the principles of the invention.

Fig. 2 is a flow sheet for a more complex system in which many molds are controlled by the same computer and in which a rheometer test is made for each batch of compound.

Fig. 3 is a program flow chart for the method illustrated in the flow sheet of Fig. 2.

Fig. 3 is shown on two sheets as Figs. 3A and 3B.

Description of Some Preferred Embodiments

A simple case involving a single mold:

The invention will probably best be understood by first describing a simple example, in which a single mold is involved and in which the information is relatively static.

The invention is applicable to a wide range of synthetic elastomers being cured and to their being molded for many uses. Much of the data verifying the invention has been obtained in the manufacture and cure of synthetic elastomer radial shaft seals. Butyl rubbers, acrylic rubbers and others have been concerned. The tests have shown that the method works on all of them.

A standard digital computer may be employed in this method. It has a data storage bank of suitable size which, of course, may vary when many molds are

used and when more refinements are employed. However, Fig. 1 shows a relatively simple case which achieves results that are vast improvements over what has been done up to now. Thus, in the manufacture of synthetic elastomer oil seals, some actual data showed that about 12.2% of time could be saved by using this invention; in other words, the molds could be in use for 12.2% more time than they had been theretofore. These data also showed that the percent rejects could be reduced by about 45% in this particular plant.

The data bank of the computer is provided with a digital input into which the time-temperature cure data for the compound involved is fed, as shown in Fig. 1. All the data is available to the computer upon call, by random access, and the call can be automatic depending upon the temperature actually involved. In other words, the computer over and over questions the data storage, asking, what is the proper time of cure for the following summation of temperatures? The question may be asked each second, and the answer is readily provided.

The mold is closed manually, as in the present practice, since this is the best way to assure that everything has been placed properly into the mold. The operator, however, has no other duties than to remove the cured articles from the mold, to put in the "prep" or blanks which are to be molded and cured, to make sure that every cavity is properly filled, and then to close the mold. He does not have to concern himself about the temperatures or cure time, because all that is taken care of automatically.

Once the mold has been closed manually, it initiates a timer in the computer, via a digital signal, which feeds the elapsed time of mold closure to the computer constantly or in a digital fashion. Thus, once each second the computer can be aware of the amount of time involved, and this can be made even more frequent if that is desired. A point of difference from the prior art, however, is that the timer itself does not directly actuate the opening of the mold, and the mold time is not a set time.

The actual mold temperature is fed to the computer on a substantially continuous basis, for example, every ten seconds. Thermocouples, or other temperature-detecting devices, located directly within the mold cavity may read the temperature at the surface where the molding compound touches the mold, so that it actually gets the temperature of the material at that surface. The computer then performs series of integrations to calculate from the series of temperature readings and from the time-temperature cure data a proper cure time and to compare that cure time with the elapsed time. Recalculation continues until the time that has elapsed since mold closure corresponds with the calculated time. Then, the computer actuates the mold-opening device and the mold is automatically opened.

Once again, it should be stressed that the computer is not simply working on one time-temperature curve, it is working on a whole series of them, so that the proper compensation is made for the changes of temperature that occur within the mold. This

makes it possible to get a substantially exact cure time. Therefore, when the cure is calculated as complete it will be complete.

A more complex system—Fig. 2:

The relatively simple system of Fig. 1 is easily expanded within the capability of many present-day computers. For example, the computer can be used to operate a whole series of molds—50 or 60 molds—each one of them receiving the attention of the computer once a second, at which time the elapsed cure time and the calculated cure time are checked for equality.

Data storage can be expanded by including in the data storage bank the time-temperature cure data for all compounds and for past batches of various compounds. Random access enables the data for any particular compound to be made available to the computer upon request, which the computer makes when it is told what compound is being used.

Furthermore, the rheometer test can be made for each batch of the compound to determine the minimum torque and maximum torque as well as intermediate torque levels and temperature, all of which are used to determine cure time in accordance with the Arrhenius equation as explained hereinbelow. This means that each batch can be differentiated and corrections made on the basis of data in the data storage bank which the computer has access to, so that the rheometer data for the batch are fed into the computer each time a new batch is being used in the

system. Thus the constant C referred to below is determined for each particular batch of compound being cured. It can even be used for different batches used in different parts of the same plant, that is, in different molds; the computer can take care of that, too, all within well-known capabilities.

Another factor which affects the time and temperature of curing is that of the mold geometry, and particularly the maximum thickness of the element to be molded. This factor is set out as constant x referred to hereinbelow, and for each mold and compound such data is fed into the computer to enable the computer to calculate the Arrhenius equation. The rule here is that the thickest part of the molded compound has to be completely cured. Knowing the thickest part and the dimensions of it, the results can be much more accurate than otherwise.

Thus, in the system of Fig. 2, each time a mold is closed, even though it is a different time from the closure of every other mold, it starts an elapsed timing situation within the computer per the time-temperature curve and in accordance with the actual mold temperature for each mold. With this information and the other information already mentioned, the computer continuously, for example, every ten seconds, recalculates the proper time-temperature cure and arrives at the cure time, as before stated. When this cure time for the integrated series equals the elapsed time, then each mold is separately opened at its proper elapsed time on the signal from the computer.

Fig. 3 shows a computer program flow chart for the system illustrated in Fig. 2. In Fig. 3 the computer function steps are indicated within rectangles, whereas the logic steps or questions are shown within diamond-shaped parallelograms. A timer-based interrupt 11 initiates the program once every second. Upon program initiation, the computer scans and retrieves from data storage within the computer certain operating data for the first press in the sequence of presses controlled by the computer. This function step, indicated by reference numeral 12, makes available data concerning the press mold configuration constant, the activation energy constant for the material being cured, the mold temperature set point, the constant of proportionality required to determine a temperature control range, and the total elapsed time, if any, that the press has been closed up to the instant of this step. Having available the foregoing information, the computer reaches a logic decision 21, whether the press is closed. If the press is not closed, i.e., the press is open, the program sequences directly to a calculation 41 of temperature control range data, to be subsequently discussed. If the press is closed, a program subroutine to control cure time is followed.

In this subroutine, the computer first updates at 31 the amount of time that this particular press has been closed. Next, the current mold temperature is measured at 32 by thermocouple or other heat sensing means within the mold and the measurement is converted to digital information and read by the com-

puter. The total elapsed closure time and the current temperature, along with the data previously retrieved from data storage are then used by the computer at 33 to calculate the total press closure cure time as a function of the Arrhenius equation:

$$\ln v = C Z + x$$

In this equation:

ln is the symbol for natural logarithm,

v is the total required cure time and end point for press closure.

C is the activation energy constant, a unique figure for each batch of each compounded being molded, determined in accordance with the present invention by rheometer measurements of the batch,

Z is the present mode temperature at 32, and

x is a constant dependent upon the geometry of the particular mold of the press.

This Arrhenius equation is numerically solved as follows:

$$v = e\ (cz + x)$$
$$= 1 + \frac{(cz + x)}{1\ !} + \frac{(cz + x)^2}{2\ !} + \frac{(cz + x)^3}{3\ !}$$

Once a value for *v*, the end point time has been calculated, the computer determines at 34 whether the total elapsed time as updated at 31 is equal to or greater than the calculated end point time. If the updated time at 31 equals or exceeds the calculated end point time at 33, then a control signal is generated at 35 to open the press automatically, thereby completing one scan of the press closure control sub-

routine. If this time has not yet been reached, the subroutine is for the moment completed and the program continues, but the subroutine will be repeated later, usually about once per second.

Whether the full cure time has not been reached or whether it has, the next step is the calculation at 41 of mold temperature control range data. This step may be performed as a subroutine in each scan of the press, or preferably, it may be performed with every tenth scan, or once every ten seconds. The calculation of the mold and temperature control range data is accomplished pursuant to the following Algorithm:

$$\text{Heater on/off state} = \text{Signum}\left|e(t) - K\right|$$

wherein

e(t) is the difference between the mold temperature set point and the present mold temperature and

K is a constant of proportionality set to provide the desired proportional control of the heater.

The computer next determines at 42 whether the mold heater current temperature is beyond the calculated temperature control range. If the current temperature is too high, a signal is generated at 43 to turn the mold heater off. Likewise, if the current mold temperature is too low, a control signal is generated at 43 to turn the mold heaters on. In this manner, the computer maintains close control over actual mold temperature to maintain it within a range of temperatures closely approaching and equalling the set point temperature.

The program next causes the computer to ascertain at 51 whether any change in batch data from the rheometer connected to the computer is awaiting transfer to storage. If new batch data are awaiting transfer to data storage update, the computer passes these update data at 62 to the correct storage address within the computer.

From time to time, new data concerning press mold configuration, batch characteristics, and other system parameters are entered manually by the computer control operator through a control console. Thus, on each program cycle, the computer determines at 61 whether any new data concerning the press are awaiting entry from the console. In the event of new console data, the computer then acts at 62 to transfer the data to the correct storage address within the computer data storage.

Finally, the program asks the computer to determine at 71 whether the press being controlled at the moment is the last press in the total program control sequence. If the press is the last one, the computer waits at 73 for the next program control sequence to be initiated by the timer-based interrupt 11. In other words, the presses are open for product delivery and reloading. However, if another press is to be scanned and controlled within the present program control sequence, the computer proceeds at 72 to act for all such presses and repeats the above-described program routine for those presses, commencing with step 12. With the speed and capacity of presently available computers it is possible to scan and con-

trol as many as sixty different presses within the one-second total program control sequence.

To those skilled in the art to which this invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the spirit and scope of the invention. The disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

* * * *

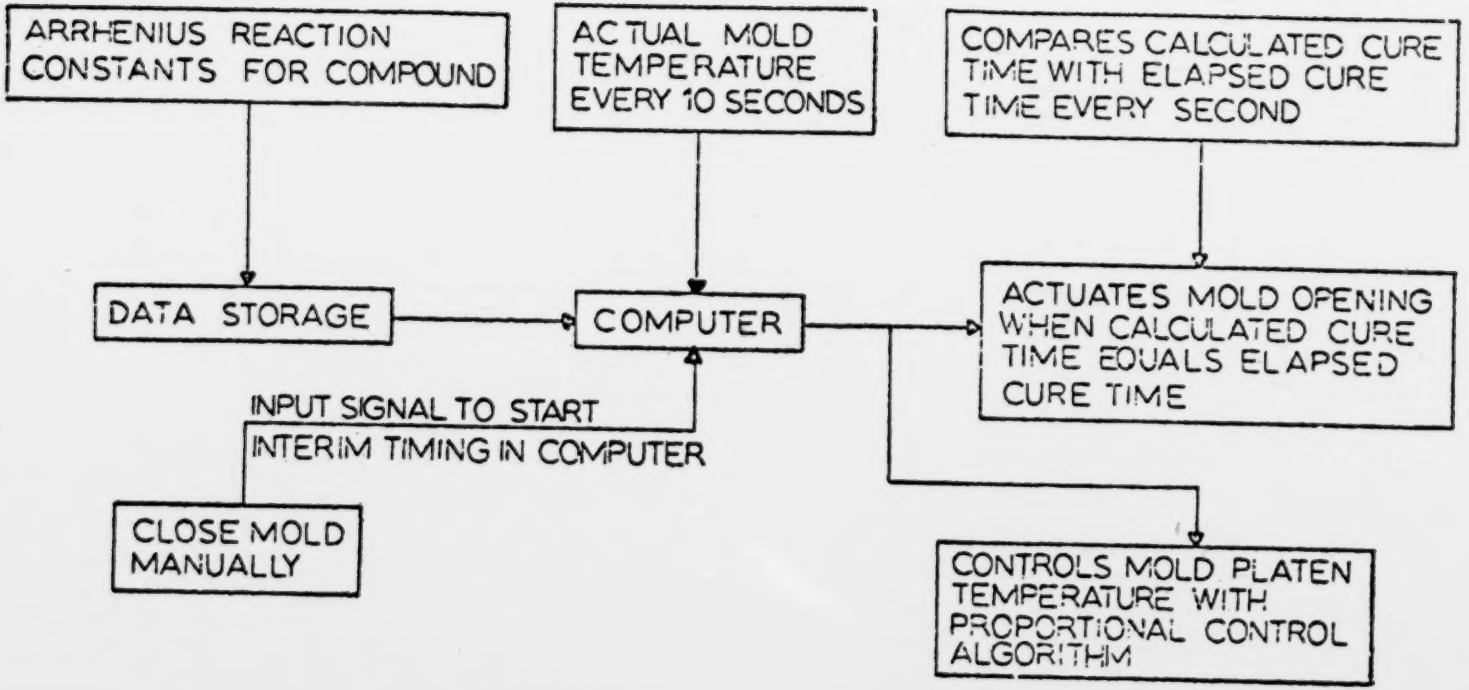

ARRHENIUS REACTION CONSTANTS FOR COMPOUND
ACTUAL MOLD TEMPERATURE EVERY 10 SECONDS
COMPARES CALCULATED CURE TIME WITH ELAPSED CURE TIME EVERY SECOND
DATA STORAGE
COMPUTER
ACTUATES MOLD OPENING WHEN CALCULATED CURE TIME EQUALS ELAPSED CURE TIME
INPUT SIGNAL TO START
INTERIM TIMING IN COMPUTER
CLOSE MOLD MANUALLY
CONTROLS MOLD PLATEN TEMPERATURE WITH PROPORTIONAL CONTROL ALGORITHM
53a

FIG. 1

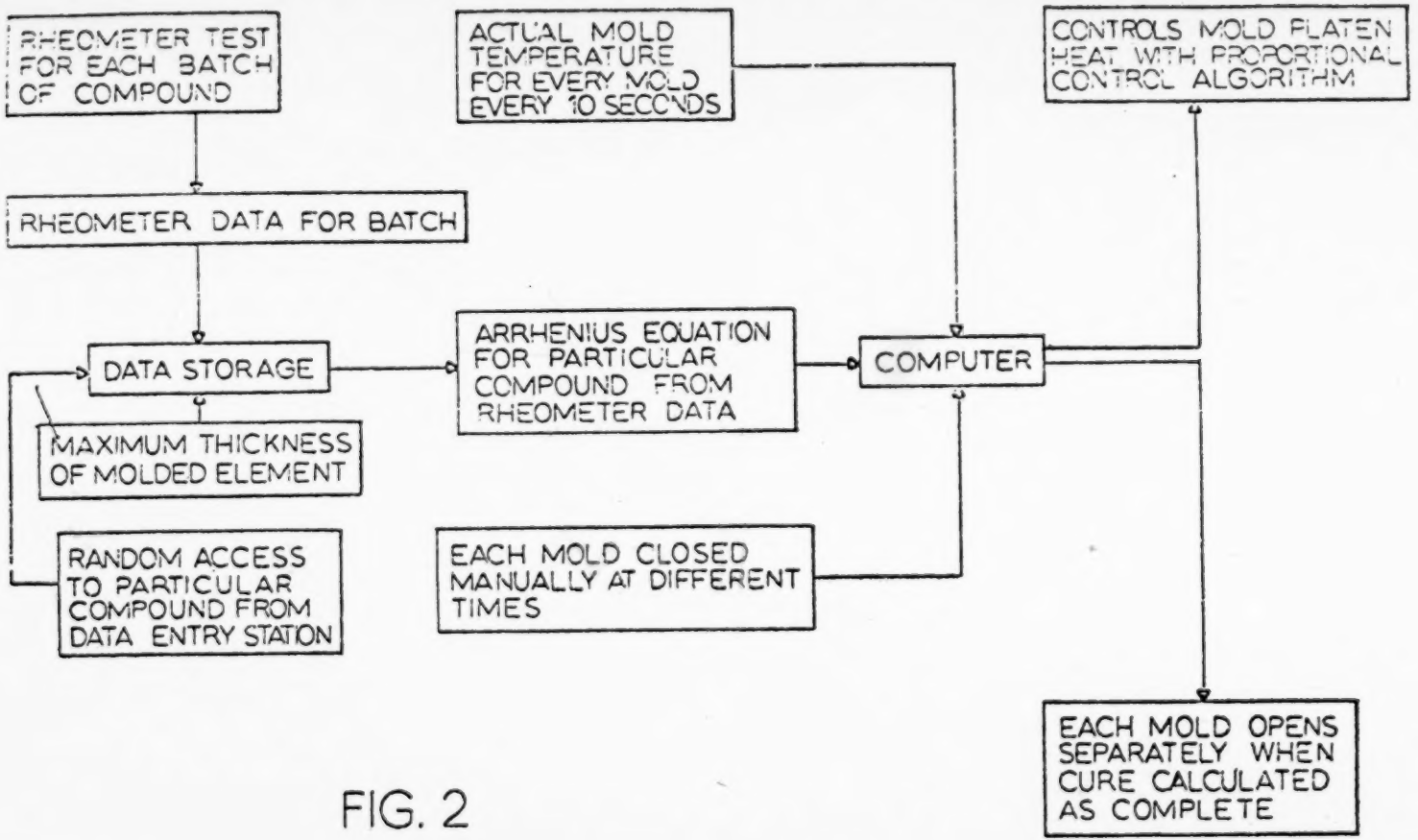

RHEOMETER TEST FOR EACH BATCH OF COMPOUND
ACTUAL MOLD TEMPERATURE FOR EVERY MOLD EVERY 10 SECONDS
CONTROLS MOLD PLATEN HEAT WITH PROPORTIONAL CONTROL ALGORITHM
RHEOMETER DATA FOR BATCH
DATA STORAGE
ARRHENIUS EQUATION FOR PARTICULAR COMPOUND FROM RHEOMETER DATA
COMPUTER
MAXIMUM THICKNESS OF MOLDED ELEMENT
RANDOM ACCESS TO PARTICULAR COMPOUND FROM DATA ENTRY STATION
EACH MOLD CLOSED MANUALLY AT DIFFERENT TIMES
EACH MOLD OPENS SEPARATELY WHEN CURE CALCULATED AS COMPLETE
54a

FIG. 2

FIG. 3-A

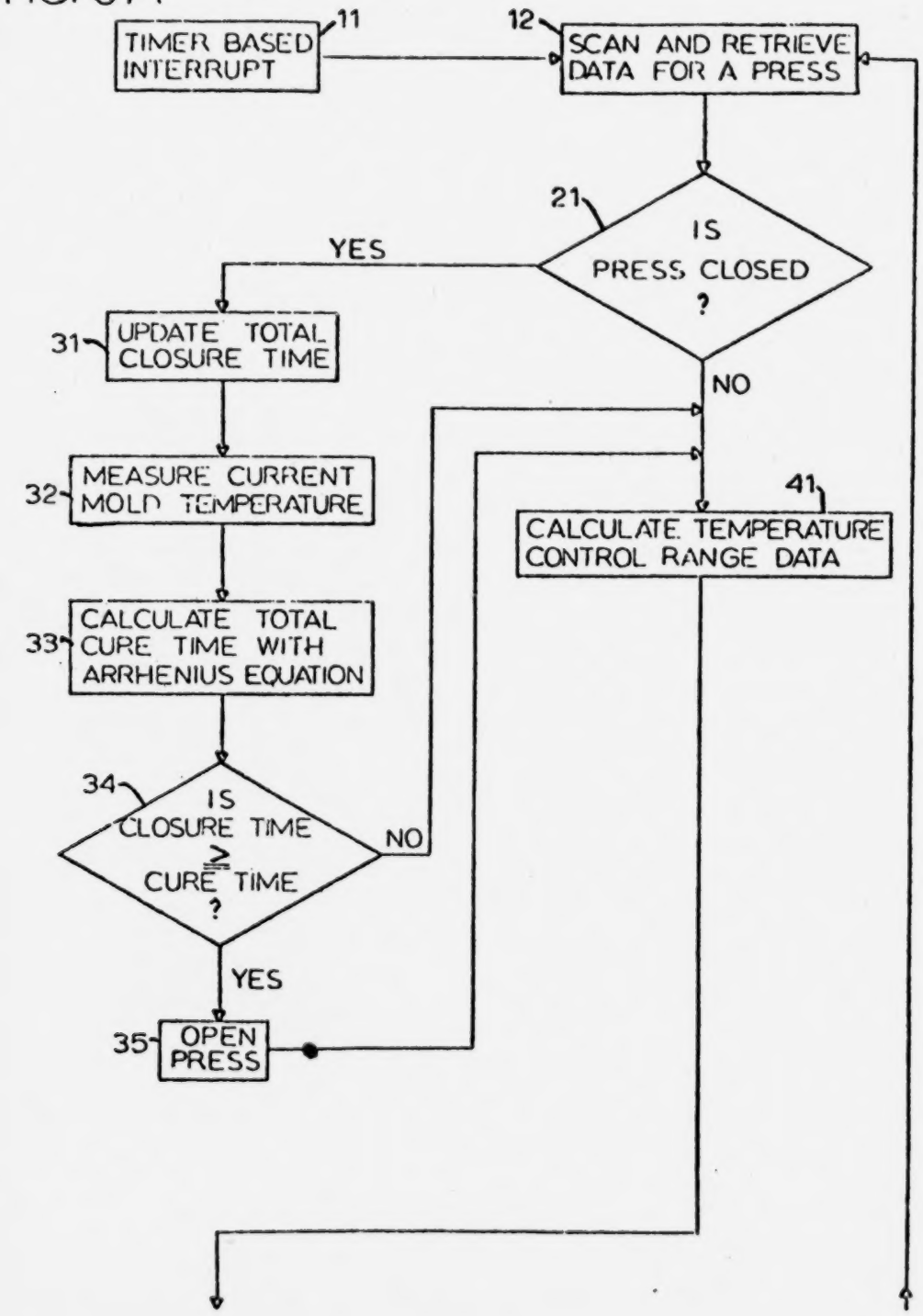
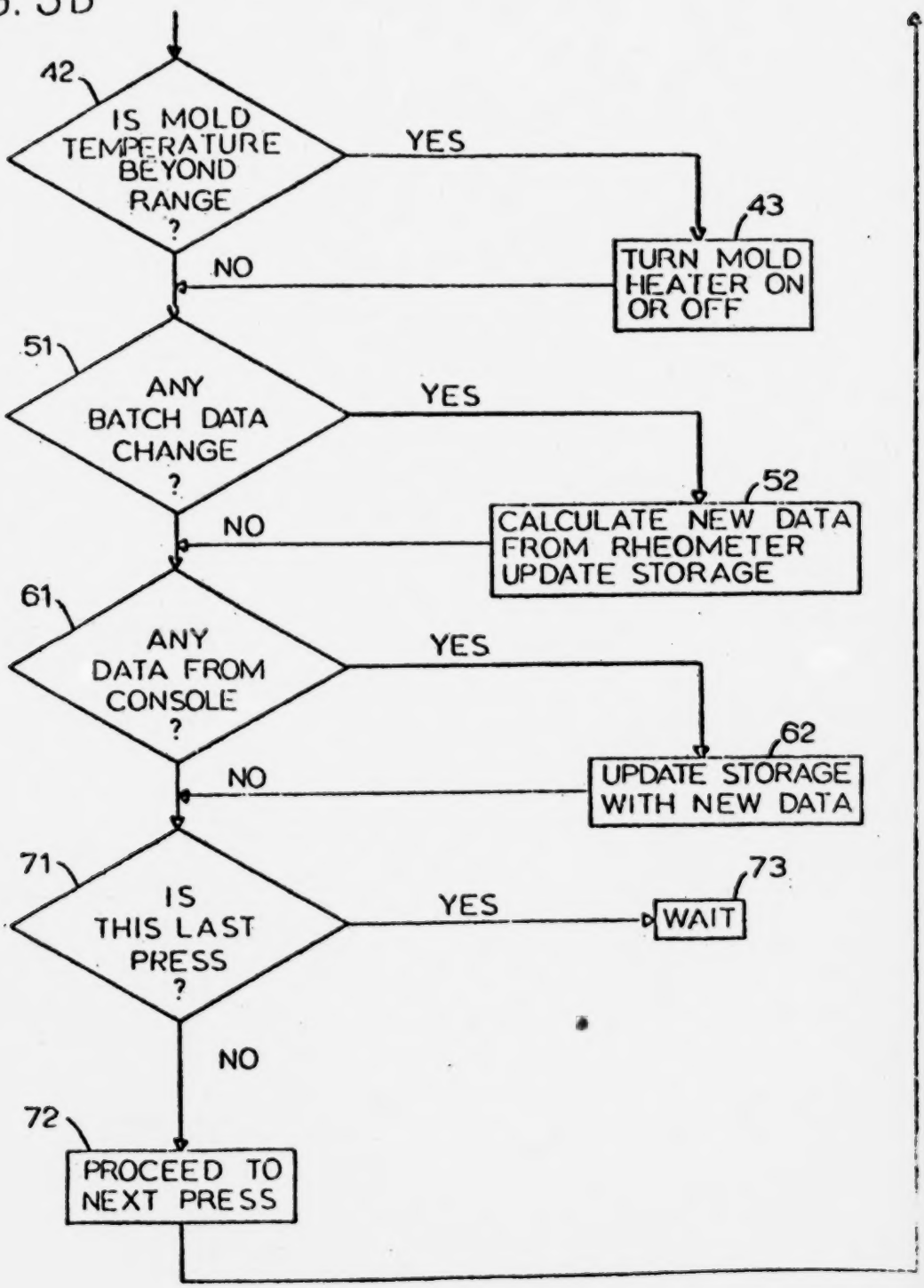

TIMER BASED INTERRUPT
11
12
SCAN AND RETRIEVE DATA FOR A PRESS
21
IS PRESS CLOSED ?
YES
NO
31
UPDATE TOTAL CLOSURE TIME
32
MEASURE CURRENT MOLD TEMPERATURE
33
CALCULATE TOTAL CURE TIME WITH ARRHENIUS EQUATION
34
IS CLOSURE TIME ≥ CURE TIME ?
NO
YES
35
OPEN PRESS
41
CALCULATE TEMPERATURE CONTROL RANGE DATA

FIG. 3-B


42
IS MOLD TEMPERATURE BEYOND RANGE ?
YES
43
TURN MOLD HEATER ON OR OFF
NO
51
ANY BATCH DATA CHANGE ?
YES
52
CALCULATE NEW DATA FROM RHEOMETER UPDATE STORAGE
NO
61
ANY DATA FROM CONSOLE ?
YES
62
UPDATE STORAGE WITH NEW DATA
NO
71
IS THIS LAST PRESS ?
YES
73
WAIT
NO
72
PROCEED TO NEXT PRESS

REJECTED CLAIMS

1. A method of operating a rubber-molding press for precision molded compounds with the aid of a digital computer, comprising:

providing said computer with a data base for said press including at least,

> natural logarithm conversion data (ln), the activation energy constant (C) unique to each batch of said compound being molded, and a constant (x) dependent upon the geometry of the particular mold of the press, initiating an interval timer in said computer upon the

closure of the press for monitoring the elapsed time of said closure.

constantly determining the temperature (Z) of the mold at a location closely adjacent to the mold cavity in the press during molding,

constantly providing the computer with the temperature (Z),

repetitively calculating in the computer, at frequent intervals during each cure, the Arrhenius equation for reaction time during the cure, which is

$\ln v = C Z + x$

where v is the total required cure time,

repetitively comparing in the computer at said frequent intervals during the cure each said calculation of the total required cure time calculated with the Arrhenius equation and said elapsed time, and

opening the press automatically when a said comparison indicates equivalence.

2. The method of claim 1 including measuring the activation energy constant for the compound being molded in the press with a rheometer and automatically updating said data base within the computer in the event of changes in the compound being molded in said press as measured by said rheometer.

3. The method of claim 1 including providing the computer with a mold temperature set point for each mold and a constant of proportionality with which a range of permissible mold temperature variation may be calculated, calculating at frequent periodic intervals in the computer the range of mold temperature variations from the set point, comparing at frequent periodic intervals in the computer the range of mold temperatures and the actual temperature, and controlling the mold heater to keep the mold temperature within the calculated range of the set point.

4. The method of claim 3 wherein the frequent periodic interval is approximately 10 seconds.

5. A method of operating a plurality of rubber molding presses simultaneously curing precision molded compounds in conjunction with a computer, comprising:

providing said computer with a data base for each said press including at least,

> natural logarithm conversion data (ln), the activation energy constant (C) unique to each batch of said compound being molded, and a constant (x) dependent upon the geometry of the particular mold of the said press.

constantly informing the computer of the temperature (Z) of each mold,

informing the computer of the batch of the compound being molded in each mold,

constantly informing the computer of the elapsed time that the compound has been in each mold,

repetitively calculating for each said press at frequent periodic intervals during each cure in the computer the Arrhenius equation to determine the total required cure time, which is $\ln v = C Z + x$, where v is the total required cure time,

repetitively comparing at said frequent periodic intervals in the computer the calculated total required cure time and the elapsed time for each said press, and

opening each said press automatically when its elapsed time has reached its calculated total required cure time.

6. The method of claim 1 wherein each said frequent interval is no longer than approximately one second.

7. A method of manufacturing precision molded articles from selected synthetic rubber compounds with the aid of a digital computer, comprising:

providing said computer with a data base for a molding press to be used in the molding, including at least,

> natural logarithm conversion data (ln), the activation energy constant (C) unique to each batch of said compound being molded, and a constant (X) dependent upon the geometry of the particular mold of the press, installing prepared

unmolded synthetic rubber of one said compound in a molding press cavity,

closing said press,

initiating an interval timer associated with said computer upon the closure of the press for monitoring the elapsed time of said closure,

constantly determining the temperature (Z) of the mold at a location closely adjacent to the mold cavity in the press during molding,

constantly providing the computer with the temperature (Z),

repetitively calculating in the computer, at frequent intervals during each cure, the Arrhenius equation for reaction time during the cure, which is

$\ln v = C Z + x$

where v is the total required cure time,

repetitively comparing in the computer at said frequent intervals during the cure each said calculation of the total required cure time calculated with the Arrhenius equation and said elapsed time,

opening the press automatically when a said comparison indicated equivalence, and

removing the resulting precision molded article from the press.

8. The method of claim 7 including measuring the activation energy constant for the compound being molded in the press with a rheometer and automatically updating said data base within the computer in the event of changes in the compound being molded in said press as measured by said rheometer.

9. The method of claim 7 including in addition,

providing the computer with a mold temperature set point for each mold and a constant of proportionality with which a range of permissible mold temperature variation may be calculated,

calculating at frequent periodic intervals in the computer said range of permissible mold temperature variations,

comparing at frequent periodic intervals in the computer said calculated range of permissible mold temperature variation and the actual temperature (Z) in the press, and

controlling the mold heater from said computer to keep the mold temperature (Z) within said calculated range of the set point.

10. The method of claim 9 wherein the frequent periodic interval is approximately 10 seconds.

11. A method of manufacturing precision molded articles from selected synthetic rubber compounds in an openable rubber molding press having at least one heated precision mold, comprising:

(a) heating said mold to a temperature range approximating a predetermined rubber curing temperature,

(b) installing prepared unmolded syntehtic rubber of a known compound in a molding cavity of predetermined geometry as defined by said mold,

(c) closing said press to mold said rubber to occupy said cavity in conformance with the contour of said mold and to cure said rubber by transfer of heat thereto from said mold,

(d) initiating an interval timer upon the closure of said press for monitoring the elapsed time of said closure,

(e) heating said mold during said closure to maintain the temperature thereof within said range approximating said rubber curing temperature,

(f) constantly determining the temperature of said mold at a location closely adjacent said cavity thereof throughout closure of said press,

(g) repetitively calculating at frequent periodic intervals throughout closure of said press the Arrhenius equation for reaction time of said rubber to determine total required cure time v as follows:

$$\ln v = cz + x$$

wherein c is an activation energy constant determined for said rubber being molded and cured in said press, z is the temperature of said mold at the time of each calculation of said Arrhenius equation, and x is a constant which is a function of said predetermined geometry of said mold,

(h) for each repetition of calculation of said Arrhenius equation herein, comparing the resultant calculated total required cure time with the monitored elapsed time measured by said interval timer,

(i) opening said press when a said comparison of calculated total required cure time and monitored elapsed time indicated equivalence, and

(j) removing from said mold the resultant precision molded and cured rubber article.

APPENDIX F

UNITED STATES PATENT OFFICE

3,718,721

Feb. 27, 1973

METHOD FOR CONTROLLING THE STATE OF CURE OF CURABLE ARTICLES

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Filed: January 26, 1970

ABSTRACT

A method for controlling the state of cure of at least a part of a curable article during curing in a mould, in which a temperature sensing probe is inserted into a predetermined site in the article and the temperature of the site is monitored as a function of time. The state of cure of the site is computed from the temperature measurements and heating is discontinued when a predetermined state of cure has been reached, of which the following is a specification.

* * * * *

METHOD FOR CONTROLLING THE STATE OF CURE OF CURABLE ARTICLES

This application is a continuation-in-part of our copending application Ser. No. 857,175, filed Sept. 11, 1969, now U.S. Pat. No. 3,649,729, which is a continuation-in-part of Ser. No. 857,642, filed Sept. 10, 1969, now abandoned, which is a streamlined continuation of Ser. No. 640,320, filed May 22, 1967, now abandoned.

This invention relates to the curing of curable articles and is particularly concerned with controlling the state of cure of rubber articles.

In the manufacture of rubber articles, where the article is made from or includes a vulcanizable rubber compound, it is necessary to cure the compound by heating it to effect vulcanization. An optimum state of cure is obtainable for any given rubber compound, the physical properties of the cured rubber being adversely affected by substantial over or under cure.

Over cure or under cure is sometimes obtained on account of variations, during a cure of predetermined duration, in the temperature of the steam utilized for heating moulds within which rubber articles are cured. Variation in the temperature of the mould can also take place due to variation in the ambient temperature, variation in the temperature of the heating media and the transfer of heat therefrom to an article to be cured, the degree of use to which the mould is put, i.e. the amount of heat extracted from the mould per unit time and the period during which the mould is left open between curing operations. It is, therefore, desirable to have a method of or an apparatus for, controlling the state of cure of the article.

According to the present invention, a method of controlling the state of cure of at least a part of a curable article during heat curing thereof in a mould comprises locating a temperature sensing probe at a predetermined site within the article, initiating the cure cycle by supplying heat to the article, monitor-

ing the local temperature of said site as a function of time, computing therefrom the total state of cure of said part of the article as a function of time, and terminating the heat supply when a predetermined state of cure has been reached.

State of cure can be determined in terms of a number of cure units, one cure unit being defined as that cure received at the point under consideration in the article when maintained at a specified reference temperature for 1 minute.

The process of curing is a chemical reaction the rate of which depends on temperature. The relationship between temperature and rate of reaction can be determined experimentally and it can be shown that the relationship can be expressed by the Arrhenius equation thus:

$$t_1/t_2 = \exp[-E/R(1/T_2 - 1/T_1)]$$

where

R 32 Universal gas constant

E = activation energy. This is determined from the slope of a graph of log (time) against the reciprocal of the absolute temperature. A typical figure is 20 K cal/mole

t_1 is the time to desired state of cure at steady temperature T_1

t_2 is the time to the same state or cure at steady temperature T_2

Thus if the time t_1 to reach a desired state of cure at a specified reference temperature T_1 is known, the time to reach the same state of cure at other temperatures can be calculated.

In practical cures the actual rubber temperature is not usually steady. However, the cure time at the reference temperature T_1 equivalent to the actual cure time t_3 during which the temperature has varied can be calculated using a method of numerical integration. This consists of dividing the time-temperature curve for the actual cure into small units of time, d_1, estimating the average temperature during the time interval dt and converting this to the equivalent time of cure at the reference temperature T_1. These small increments of cure are then summed to give the equivalent total cure time at the reference temperature T_1 i.e. the state of cure.
Cure time at

$$T_1 = \sum_{0}^{t_1} \exp.\left(-\frac{E}{R}\left(\frac{1}{T} - \frac{1}{T_1}\right)\right)\mu$$

where T is the mean temperature during each time interval.

Instead of the Arrhenius equation it is possible to use empirical equations which fit the observed data e.g.

$$t_1/t_2 = (T_2 - T_1/CY)$$

where C and Y are constants.

For a selected reference temperature of 287°F, the state of cure at any temperature $T°F$, after an elapsed time of cure of t minutes is expressed as $(t\ C/T\text{-}287/Y)$ cure units, where C and Y are constants. The above expression has been determined experimentally and in one example for natural or synthetic rubber articles, $C = 2.0$ and $Y = 18$.

A third alternative is a polynomiall equation expressing the relationship between the change of properties with temperature and time.

The method of the invention thus renders it possible to calculate the state of cure at the point under consideration at any time in terms of aggregate number of cure units and to terminate the cure when the desired cure corresponding to a predetermined aggregate number of cure units has been obtained. The time of cure which will provide a specified number of cure units, will vary from one article to another sample of the same article, since as the cure temperature unavoidably varies so must the duration of cure to ensure that each article receives an adequate quota of cure units to ensure that the finished cooled article is not substantially over or under cured.

Conveniently the assessment of the relationship of the actual temperature of cure with the predetermined reference temperature of cure is not commenced until a predetermined minimum temperature of the point under consideration is attained, such minimum temperature, in one example, being 210°F., for natural or synthetic rubber materials used in pneumatic tire construction.

The total state of cure may be computed directly by monitoring the local temperature of said site as a function of time. In one instance the local temperature at said site is monitored at set intervals of time and the corresponding increments of cure summated for example by means of a digital computer. In another instance the local temperature at said site is monitored as a continuous function of time, and the

change in total state of cure at every instant is integrated for example by means of an analogue device to give the accumulated state of cure at any instant.

Alternatively the total state of cure may be computed indirectly by monitoring the local temperature of said site as a function of time. The local temperature of said site may be monitored either at set intervals of time or continuously as a function of time, the deviation from a predetermined ideal temperature time variation determined at regular intervals or continuously respectively, and an adequate correction applied by suitable adjustment of the heat supply so that the total state of cure may be computed by reference to the ideal temperature time variation.

The said predetermined state of cure may be less than the state of cure required in the completed article to compensate for the additional curing by the heat remaining in the article after the heat supply has been terminated due to the finite thermal diffusivity of the material of the article.

In addition often it is of advantage to allow the article to remain in the mould after the heat supply has been terminated and until such time as adequate cooling of the article has been achieved to allow the article to cool under controlled conditions. At the end of the cure cycle i.e. after the article has cooled sufficiently the mould is opened either manually or automatically. The latter may be carried out by actuation by the computer of a suitable device operably attached to the mould to open the mould, when the temperature sensing probe registers a suitable temperature.

Preferably the temperature sensing probe is located within the article at a site which after the heat supply has been terminated, has the lowest state of cure.

According to another aspect of the invention, apparatus for controlling the state of cure of at least part of an article during the heat curing thereof in a mould comprises a mould, a mould heating means, a mould cavity defined by the mould, a temperature sensing probe, a substantially rectilinear channel suitably disposed in the wall of the mould, communicating the mould exterior with the mould cavity, and adapted to allow said temperature sensing probe to pass therethrough, monitoring means connected to the temperature sensing probe, for monitoring signals received therefrom as a function of time, computing means cooperating with the monitoring means for computing the total state of cure of the part of the article, and means for rendering the mould heating means inoperative when a predetermined state of cure has been reached.

The temperature sensing probe may be provided with a reinforcing sheath to impart the necessary rigidity thereto.

The said sheath may comprise a metal or alloy of suitable modulus suitable results having been obtained with stainless steel.

It is preferable that the temperature sensing probe comprises a thermocouple although other temperature sensing means e.g. a resistance thermometer, may be adapted to the present application.

It is also preferred that the thermocouple leads are insulated over the length of the temperature sensing probe thus limiting heat transmitted by conduction, from regions of the article or mould not under observation, through the leads to the couple thermo-junction, it being found that mineral insulations are particularly applicable in this respect e.g. magnesium oxide.

Temperature sensing probes may be provided at several different locations in a single article and the signals from all of these fed to a computer which selects only that temperature value which indicates that that point will have the lowest state of cure at the time when the heat supply is terminated.

An alarm system may be provided which is operable if any or all of the factors contributing to a satisfactory cure of the tire deviate substantially from a predetermined range of values.

The invention also includes an article cured by a method or on an apparatus according to the present invention e.g. a pneumatic tire.

* * * *

Having now described our invention what we claim is:

1. A method of controlling the state of cure of at least a part of a curable article during heat curing thereof in a mould comprising locating said article within a mould, said mould including a temperature sensing probe located in a channel extending therethrough, closing said mould and shaping the article against said mould, thereby locating said probe in a

predetermined site within said article, initiating the cure cycle by supplying heat to the article, monitoring the local temperature of said site as a function of time, computing therefrom the total state of cure of said part of the article as a function of time and terminating the heat supply when a predetermined state of cure has been reached, said total state of cure of the part of the article being computed in terms of a number of cure units, one cure unit being that cure received at the point under consideration in the article when maintained at a specified reference temperature for one minute.

2. A method according to claim 1 in which the number of cure units is computed using the Arrhenius equation.

3. A method according to claim 1 in which the number of cure units is computed using the expression $tC^{(T_2-T_1)}/y$ which gives the state of cure at a temperature T_2 where t is the elapsed time of cure, T_1 is the predetermined reference temperature and C and Y are constants.

4. A method according to claim 3 in which the curable article is a natural or synthetic rubber article, $C = 2.0$ and $Y = 18$.

5. A method according to claim 1 in which the assessment of the relationship of the actual temperature of cure with the predetermined reference temperature of cure is not commenced until a predetermined minimum temperature of the point under consideration is attained.

6. A method according to claim 1 in which the total state of cure at the predetermined site is computed directly by monitoring the local temperature of the site as a function of time.

7. A method according to claim 1 in which the total state of cure is computed indirectly by monitoring the local temperature of said site as a function of time, the local temperature of the site and its deviation from a predetermined ideal temperature-time variation being determined at regular intervals or continuously, and an adequate correction being applied by suitable adjustment of the heat supply.

8. A method according to claim 1 in which the predetermined state of cure is less than the state of cure required in the finished article to compensate for the additional curing by the heat remaining in the article after the heat supply has been terminated.

9. A method according to claim 1 in which the temperature sensing probe is located within the article at a site which, after the heat supply has been terminated, has the lowest state of cure.

10. A method according to claim 1 in which the article is a rubber tire.

11. A method according to claim 10 in which the tire is a cross-ply tire and predetermined site is in the lower shoulder region of the tire.

* * * * *

APPENDIX G

UNITED STATES PATENT OFFICE

3,649,729

Patented Mar. 14, 1972

3,649,729

METHOD OF CURING A RUBBER OR PLASTIC TIRE

Edward P. Davis, 77 Elmcroft Road, Yardley, Birmingham, England, and Eric G. Gould, 6 Hawthorn Road, Wylde Green, Sutton Coldfield, England

Continuation-in-part of abandoned application Ser. No. 857,642, Sept. 10, 1969, which is a continuation of application Ser. No. 640,324, May 22, 1967. This application Sept. 11, 1969, Ser. No. 857,175

Claims priority, application Great Britan, Mar. 24, 1966,

12,969/66

Int. Cl. B29h *5/02*; G01n *25/00*

U.S. Cl.264—40 13 Claims

ABSTRACT OF THE DISCLOSURE

A method for determining the state of cure of a rubber or plastics article, such as a pneumatic tire, during its cure cycle by sensing the temperature of the article at its surfaces, calculating therefrom the temperature at a point in the article at which an

adequate state of cure is desired and thence determining the state of cure at such point. Also the process for curing a rubber or plastics article which includes using the above method to determine the state of cure at a point in the article and terminating the cure when a desired state of cure at that point has been reached, of which the following is a specification.

This application is a continuation-in-part of application Ser. No. 857,642, filed Sept. 10, 1969, now abandoned, which in turn is a continuation of application Serial No. 640,324 filed May 22, 1967, now abandoned.

This invention relates to the curing of rubber or plastics articles and is particularly concerned with the determination of the state of cure of rubber articles.

In the manufacture of rubber articles, where the article is made from or includes a vulcanizable rubber compound, it is necessary to cure the compound by heating it to effect vulcanization. An optimum state of cure is obtainable for any given rubber compound, the physical properties of the cured rubber being adversely affected by substantial over or under cure.

Over cure or under cure is sometimes obtained on account of variations, during a cure of a predetermined duration, in the temperature of the steam utilised for heating moulds within which rubber articles are cured. Variation in the temperature of the

mould can also take place due to variation in the ambient temperature, variation in the temperature of the heating media and the transfer of heat therefrom to an article to be cured, the degree of use to which the mould is put, i.e. the amount of heat extracted from the mould per unit time and the period during which the mould is left open between curing operations. It is, therefore, desirable to have a method of or an apparatus for, determining the state of cure of the article.

According to the invention there is provided a method of determining the state of cure of a part at least of a rubber or plastics article during the curing thereof comprising sensing at intervals of time the temperature of cure at at least two boundary surfaces of the article, calculating, from each set of said boundary surface temperatures, the corresponding temperature at a point at which an adequate state of cure is desired, said point being located between the boundary surfaces, assessing the relationship of the calculated cure temperature with a predetermined reference temperature of cure and accounting for the elapsed time of cure to determine the state of cure at said point in the article.

In one example of the above method the calculated cure temperature is compared with the predetermined reference temperature of cure to determine the variation between the two temperatures and wherein the temperatures of cure at the boundary surfaces of the article are sensed at uniform intervals of time, said boundary temperatures being sensed at the commence-

ment of each time interval and the corresponding temperature at the point at which said adequate state of cure is desired being forecast for the end of such time interval.

This is forecast using a calculation based on a knowledge of the dimensions of the article, the thermal properties of the article and the time-temperature conditions at surfaces where heat is applied to the article.

* * * * *

The method according to the invention thus renders it possible to calculate the state of cure at the point under consideration at any time in terms of aggregate number of cure units and to terminate the cure when the desired cure corresponding to a predetermined aggregate number of cure units has been obtained. The time of cure which will provide a specified number of cure units, will vary from one article to another sample of the same article, since as the cure temperature unavoidably varies so must the duration of cure to ensure that each article receives an adequate quota of cure units to ensure that the finished cooled article is not substantially over or under cured.

* * * * *

The apparatus for determining the state of cure of a part at least of a rubber or plastics article comprises at least two temperature sensors locatable one at each of at least two boundary surfaces of the article to be cured, calculating means for determining the temperature of the article at a point between the

boundary surfaces at which an adequate state of cure is desired, means for assessing the relationship of the calculated temperature with a predetermined reference temperature of cure and means for accounting for the elapsed time of cure to determine the state of cure at said point in the article.

Preferably the calculating means, the means for assessing the relationship of the calculated temperature with the reference temperature and the means for accounting for the elapsed time of cure comprises a computer device.

An alarm system may be provided which is operable if any or all of the factors contributing to a satisfactory cure of the tire deviate substantially from a predetermined range of values.

Also in accordance with the invention there is provided a cured rubber or plastics article e.g. a pneumatic tire, wherein the state of cure during the curing of such an article has been determined by the method or apparatus described above.

* * * * *

Having now described our invention what we claim is:

1. A method of curing a rubber or plastics tire by controlling the amount of cure at a point within said tire remote from direct measurement thereof comprising:

(a) initially heating said tire;

(b) thereafter at intervals of time measuring the temperature of at least two boundary surfaces at points which, together with the point within said tire, lie on a straight line parallel to the direction of heat flow through the tire;

(c) determining the temperature at said point within the tire from said boundary temperatures as a function of the thermal conductivity, density and specific heat of said tire along said straight line at the then existing temperature of said tire and continuing the heating of said tire as a function of the temperature at said point;

(d) determining the state of cure in cure units at said point within said tire from said temperature at said point,

(e) terminating the heating of said tire when the state of cure in cure units at said point within said tire reaches a predetermined level which is the number of cure units necessary to achieve the desired cure, one cure unit being the amount of cure inserted per unit time at a point in the tire when the temperature at that point is a selected reference temperature.

2. A method according to claim 1 in which the number of cure units at said point within said tire is defined by the expression

$$tC \quad \frac{(T_2 - T_1)}{Y}$$

where t is the elapsed time of cure, T_1 is the selected reference temperature and C and Y are constants.

3. A method according to claim 2 in which the article is a natural or synthetic rubber tire being vulcanized using sulphur and T_1=287° F., C=2.0 and Y=18.

4. A method according to claim 1 in which the number of cure units at said point within said tire is defined by the Arrhenius equation.

5. A method according to claim 1 in which the number of cure units at said point within said tire is defined by a polynomial equation.

6. A method according to claim 1 wherein determination of the state of cure in cure units is commenced after the temperature at said point reaches a predetermined temperature.

7. A method according to claim 6 wherein the minimum predetermined temperature is 210° F.

8. A method according to claim 1 in which the tire is a pneumatic tire and the curing is carried out in a mould.

9. A method according to claim 8 wherein the boundary surfaces comprise a tread surface of the tire at the shoulder region thereof and a surface adjacent said shoulder region of a cure bag or diaphragm located within the mould.

10. A method according to claim 1 in which the tire is cured in a mould further comprising:

(e) cooling said tire within said mould

(f) thereafter measuring the temperature of at least two said boundary surfaces of said tire at intervals of time

(g) continuing the cooling of said tire as a function of the temperature at a point located between the boundary surfaces of the tire, the temperature at said point being determined from the temperatures of the boundary surfaces

(h) terminating the cooling of said tire when the temperature at said point reaches a predetermined level

(i) opening said mould and removing said tire.

* * * * *

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Supreme Court, U. S.
FILED
MAY 30 1980
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APPENDIX

In the Supreme Court of the United States

OCTOBER TERM, 1979

No. 79-1112

SIDNEY A. DIAMOND, Commissioner of Patents and Trademarks,

Petitioner

—*v.*—

JAMES R. DIEHR, II, and THEODORE A. LUTTON

ON WRIT OF CERTIORARI TO THE UNITED STATES COURT OF CUSTOMS AND PATENT APPEALS

PETITION FOR A WRIT OF CERTIORARI FILED JANUARY 16, 1980
CERTIORARI GRANTED MARCH 17, 1980

In the Supreme Court of the United States

OCTOBER TERM, 1979

No. 79-1112

SIDNEY A. DIAMOND, Commissioner of Patents and Trademarks,

Petitioner

—*v.*—

JAMES R. DIEHR, II, and THEODORE A. LUTTON

ON WRIT OF CERTIORARI TO THE UNITED STATES COURT OF CUSTOMS AND PATENT APPEALS

INDEX

	Page
Docket Entries	1
*Opinion of the United States Court of Customs and Patent Appeals dated August 9, 1979	
*Mandate of the United States Court of Customs and Patent Appeals dated October 25, 1979	
*Opinion and Decision of Board of Appeals dated August 18, 1978	
*Notice of References cited dated November 18, 1975	
*Letter of Examiner dated December 2, 1975	
*Letter of Examiner dated January 26, 1976	
*Letter of Examiner dated July 8, 1976	
*Application	
*Rejected Claims	
Order Allowing Certiorari	3

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* Not reprinted in Joint Appendix. Citations are to appendix of Petition for Writ of Certiorari.

RELEVANT DOCKET ENTRIES

Filed November 27, 1978

Docket No. 79-527

IN THE MATTER OF THE APPLICATION OF
JAMES R. DIEHR, II and THEODORE A. LUTTON

FOR DIRECT DIGITAL CONTROL OF
RUBBER MOLDING PRESSES

Board of Appeals

Serial No. 602,463

DATE	PROCEEDINGS AND ORDERS

Counsel for appellant: Robert E. Wickersham, Jay M. Cantor
Robert F. Hess

Commissioner of Patents & Trademarks

January 25, 1979 Motion of appellants to extend time for filing printed transcript to February 2, 1979, filed.

January 26, 1979 Above motion granted.

January 31, 1979 PRINTED TRANSCRIPT OF RECORD, filed.

March 12, 1979 BRIEF FOR APPELLANT, filed.

April 9, 1979 Motion of Commissioner of Patents to extend time for filing brief to April 30, 1979, filed.

April 10, 1979 Above motion granted.

April 30, 1979 BRIEF FOR COMMISSIONER OF PATENTS & TRADEMARKS, filed.

June 6, 1979 Argued (Judge Cowen, sitting)

June 15, 1979 Letter from appellant regarding question in court received.

DATE	PROCEEDINGS AND ORDERS

August 9, 1979 Reversed, Rich, Judge.

August 30, 1979 PETITION FOR REHEARING BY COMMISSIONER, filed.

September 6, 1979 OPPOSITION TO PETITION FOR REHEARING BY APPELLANT, filed.

October 18, 1979 Petition for rehearing denied.

October 25, 1979 FINAL MANDATE ISSUED TO THE COMMISSIONER OF PATENTS AND TRADEMARKS

January 16, 1980 Petition for Writ of Certiorari file in U.S. Supreme Court, No. 79-1112.

March 17, 1980 Petition for Writ of Certiorari granted. (To be heard same day as 79-533 Bradley et al.)

SUPREME COURT OF THE UNITED STATES

No. 79-1112

SIDNEY A. DIAMOND, Commissioner of Patents and Trademarks, PETITIONER

v.

JAMES R. DIEHR, II and THEODORE A. LUTTON

ORDER ALLOWING CERTIORARI

Filed March 17, 1980

The petition herein for a writ of certiorari to the United States Court of Customs and Patent Appeals is granted. The case is set for oral argument in tandem with No. 79-855. *Diamond* v. *Bradley, et al.*

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Supreme Court, U.S.
FILED
FEB 15 1980
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In the Supreme Court

OF THE

United States

OCTOBER TERM, 1979

No. 79-1112

SIDNEY A. DIAMOND, COMMISSIONER OF PATENTS AND TRADEMARKS,
Petitioner,

vs.

JAMES R. DIEHR, II, and THEODORE A. LUTTON
Respondents.

BRIEF IN OPPOSITION TO A PETITION FOR A WRIT OF CERTIORARI TO THE UNITED STATES COURT OF CUSTOMS AND PATENT APPEALS

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SUBJECT INDEX

	Page
Question presented	1
Statement of facts	2
Argument: Reasons for denying the petition	7
1. The "Question Presented" on page 2 of the petition is not involved in the case	7
2. The decision below is a correct application of the law as enunciated in Gottschalk v. Benson and Parker v. Flook	9
3. A patent claim drawn to subject matter that is otherwise patentable under § 101 does not become unstatutory merely because the computer is involved	14
4. Considerations of novelty and obviousness do not bear on Section 101	16
5. There should be no consolidation with Diamond v. Bradley and Franklin	17
Conclusion	18

TABLE OF AUTHORITIES CITED

Cases

Page

Bradley and Franklin, In re, 600 F.2d 807, 202 USPQ 480 (CCPA 1979) 13, 17

Chatfield, In re, 545 F.2d 152, 191 USPQ 730 (CCPA 1976) cert. denied, 434 U.S. 875 (1978) 13

Christensen, In re, 478 F.2d 1392, 178 USPQ 35 (CCPA 1973) 13

de Castelet, In re, 562 F.2d 1236, 195 USPQ 439 (CCPA 1977) 13

Deutsch, In re, 553 F.2d 689, 193 USPQ 645 (CCPA 1977) .. 13

Eibel Process Co. v. Minnesota and Ontario Paper Co., 261 U.S. 45, 43 S.Ct. 322 (1922) 8, 11, 14, 18

Freeman, In re, 573 F.2d 1237, 197 USPQ 464 (CCPA 1978) .. 13

Funk Bros. Seed Co. v. Kalo Co., 333 U.S. 127, 76 USPQ 280 (1948) 11

Gelnovatch, In re, 595 F.2d 32, 201 USPQ 136 (CCPA 1979) 13

Gottschalk v. Benson, 409 U.S. 63, 93 S.Ct. 253, 34 L.ed.2d 273 175 USPQ 673 (1972) 9, 10, 11, 13, 15, 18

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Maucorps, In re, 609 F.2d 481, 203 USPQ 812 (CCPA 1979) .. 13

Noll, In re, 545 F.2d 141, 191 USPQ 721 (CCPA 1976); cert. denied, 434 U.S. 875 (1978) 13

Parker v. Flook, 437 U.S. 584, 98 S.Ct. 2522, 57 L.ed.2d 451, 198 USPQ 193 (1978) 9, 10, 11, 13, 14, 15, 18

Phillips, In re, 608 F.2d 879, 203 USPQ 971 (CCPA 1979) 13

Richman, In re, 563 F.2d 1026, 195 USPQ 340 (CCPA 1977) .. 13

Sarkar, In re, 588 F.2d 1330, 200 USPQ 132 (CCPA 1979) 13

Tilghman v. Proctor, 102 U.S. 707 (1881) 8, 11, 14, 18

Toma, In re, 575 F.2d 872, 197 USPQ 852 (CCPA 1978) 13

Waldbaum, In re, 559 F.2d 611, 194 USPQ 465 (CCPA 1977) 13

TABLE OF AUTHORITIES CITED

Rule

	Page
Rules of the Supreme Court of the United States, Rule 19 ...	9

Statutes

35 U.S.C.:	
Section 101	passim
Section 102	16
Section 103	16
Section 112	7

In the Supreme Court

OF THE

United States

OCTOBER TERM, 1979

No. 79-1112

SIDNEY A. DIAMOND, COMMISSIONER OF PATENTS AND TRADEMARKS,
Petitioner,

VS.

JAMES R. DIEHR, II, and THEODORE A. LUTTON
Respondents.

BRIEF IN OPPOSITION TO A PETITION FOR A WRIT OF CERTIORARI TO THE UNITED STATES COURT OF CUSTOMS AND PATENT APPEALS

Respondents oppose the grant of a writ of certiorari to review the unanimous judgment of the United States Court of Customs and Patent Appeals in this case.

Respondents have no disagreement with the Petition as to the citation of the opinion below, its reproduction in the appendix to the Petition, the jurisdiction, or the statute involved (35 U.S.C. § 101) and its reproduction in the Petition.

QUESTION PRESENTED

The "Question Presented" by Petitioner is not even involved in this case. It is far from what is involved, and is so inaccurate and so improper that it becomes necessary to present the following counterstatement, which is substan-

tially what the CCPA found (see second sentence of the section headed OPINION):

Does a patent process claim drawn to subject matter which is otherwise statutory become nonstatutory merely because a computer is involved in execution of a portion of the process?

As specifically applied to the facts herein, the issue becomes whether a claim to a process for molding precision rubber products, normally considered as a process within the terms of 35 U.S.C. § 101, becomes unpatentable because a programmed computer is used to determine the time when a cure is complete and the mold is opened.

STATEMENT OF FACTS

The statement of facts in the Petition is only partly correct. Most importantly and contrary to the Petition, it should be clearly understood that this invention does not involve any attempt to patent an algorithm, an equation, or any form of mathematics nor any means, computer included, of performing calculations pursuant thereto.

The invention is a process and relates directly to the molding of synthetic rubber into precision products. The molding process is performed under heat and pressure and includes curing rubber in the mold so that the product will retain its shape and be functionally operative after the molding is completed.

The claimed technology is chemical and mechanical, not mathematical. However, in all processes involving cure of synthetic rubber, the cure time must be determined. This

may be done by guesswork, or it may be calculated by means of an old, well-known equation[1] on the basis of the temperature of the mold. The trouble is that the temperature inside the mold varies appreciably, so that there is no one "temperature of the mold" on which a single calculation may be based. The present invention uses the same old equation but repeatedly recalculates the cure time using frequently updated readings of the *actual* instantaneous temperature in the mold. When the recalculated cure time coincides with the actual time that the mold has been closed, the mold is opened automatically.

This method of manufacturing precision molded articles from uncured synthetic rubber is set forth in claim 11, which is a representative broad claim:

> 11. A method of manufacturing precision molded articles from selected synthetic rubber compounds in an openable rubber molding press having at least one heated precision mold, comprising:
>
> (a) heating said mold to a temperature range approximating a predetermined rubber curing temperature,
>
> (b) installing prepared unmolded synthetic rubber of a known compound in a molding cavity of predetermined geometry as defined by said mold,
>
> (c) closing said press to mold said rubber to occupy said cavity in conformance with the contour of said mold and to cure said rubber by transfer of heat thereto from said mold,

---

[1]The equation is known as the Arrhenius equation, after its discoverer Svante Arrhenius (1859-1927) who received the Nobel prize for chemistry in 1903.

(d) initiating an interval timer upon the closure of said press for monitoring the elapsed time of said closure,

(e) heating said mold during said closure to maintain the temperature thereof within said range approximating said rubber curing temperature,

(f) constantly determining the temperature of said mold at a location closely adjacent said cavity thereof throughout closure of said press,

(g) repetitively calculating at frequent periodic intervals throughout closure of said press the Arrhenius equation for reaction time of said rubber to determine total required cure time v as follows:

$$\ln v = cz + x$$

wherein c is an activation energy constant determined for said rubber being molded and cured in said press, z is the temperature of said mold at the time of each calculation of said Arrhenius equation, and X is a constant which is a function of said predetermined geometry of said mold,

(h) for each repetition of calculation of said Arrhenius equation herein, comparing the resultant calculated total required cure time with the monitored elapsed time measured by said interval timer,

(i) opening said press when a said comparison of calculated total required cure time and monitored elapsed time indicated equivalence, and

(j) removing from said mold the resultant precision molded and cured rubber article.

Note that claim 11 has only one calculation step out of its ten steps.

The application also relates to a method for operating a rubber molding press, as stated in claim 1, which is also a representative broad claim:

1. A method of operating a rubber-molding press for precision molded compounds with the aid of a digital computer, comprising:

providing said computer with a data base for said press including at least,

natural logarithm conversion data (ln),

the activation energy constant (C) unique to each batch of said compound being molded, and a constant (x) dependent upon the geometry of the particular mold of the press, initiating an interval timer in said computer upon the

closure of the press for monitoring the elapsed time of said closure.

constantly determining the temperature (Z) of the mold at a location closely adjacent to the mold cavity in the press during molding,

constantly providing the computer with the temperature (Z),

repetitively calculating in the computer, at frequent intervals during each cure, the Arrhenius equation for reaction time during the cure, which is

$\ln v = CZ + x$

where v is the total required cure time,

repetitively comparing in the computer at said frequent intervals during the cure each said calculation of the total required cure time calculated with the Arrhenius equation and said elapsed time, and

opening the press automatically when a said comparison indicates equivalence.

Claim 1 has one data base step and only one calculating step, among at least six steps.

Claims 11 and 1 exemplify the invention for which the patent is sought. This process invention *utilizes* (1) a molding press, (2) a heater for the molding press, (3) an interval timer, (4) a thermostat, (5) a temperature measuring device located in the mold adjacent to the mold cavity, and (6) a programmed computer. All these devices are needed to obtain the desired molded rubber product.

The claimed mechanical-chemical process involves placing uncured synthetic elastomer in the mold, forming it to a precise shape, curing it in that shape, and then removing the precision-molded and cured product from the mold. The process produces a better rubber product because the product is more accurately cured. It produces more products per unit time because it eliminates the time wasted heretofore in over-curing just to be sure that the products were cured for a long enough time. It also eliminates the waste in time and materials due to the necessity of re-making improperly cured products. Respondents' novel process has now been in use in manufacturing plants for several years and it has saved many thousands of dollars for the assignee, Federal-Mogul Corporation, while supplying the public with much better products.

The purpose of the process is to improve the quality of the molded rubber products and to increase the efficiency of their production. It does not purport to improve computers, nor does the application claim a computer program, an algorithm or a calculation.

In a strict sense, the application does not disclose a computer program, but (in order to meet the disclosure requirements of 35 U.S.C. § 112) the application contains flow sheets from which a competent programmer can set up a program tailored to the particular computer which a user may select. The exact program used and the identity of the computer selected are immaterial to the invention.

No exception is taken to the Petitioner's statements about the actions by the patent examiner and the Patent and Trademark Office Board of Appeals. As to what the Court of Customs and Patent Appeals did, its own opinion is printed as Petitioner's Appendix A and speaks for itself. Note, *inter alia,* that the CCPA, although regarding the novelty of the step of continually measuring the temperature in the mold cavity as irrelevant to the § 101 issue, did regard that step as novel (Petition Appendix A, p. 13a and n.5, 602 F.2d at 987, n.5).

ARGUMENT: REASONS FOR DENYING THE PETITION

1. The "Question Presented" on Page 2 of the Petition Is Not Involved in the Case

Petitioner states that the question is:

> "Whether a computer program that regulates the curing time of rubber products in a mold is patentable subject matter under 35 U.S.C. 101"

Respondents are not attempting to patent a computer program. While the CCPA stated in a footnote (Petition Appendix A. p. 5a, n.3, 602 F.2d at 984, n.3) that the applicants' flow sheet *discloses* a computer program, it never said that the *claims* were directed to a computer

program. The claims are not directed to a computer program, even in part, and the CCPA rightly concluded:

> "Each of appellants' claims, *as a whole,* recites a process or method for molding rubber articles. They are an improvement over prior processes in that appellants provide for opening the mold at precisely the correct time rather than at a time which has been determined by approximation or guesswork. It is this feature of the process that *involves* the Arrhenius equation. The recitation of the equation is not separable from the process in which it is used; it is intimately involved in the process, but the claims are not to the equation. We find these claims to be directly comparable to those involved in *Tilghman v. Proctor,*[2] supra, and *Eibel Process Co. v. Minnesota and Ontario Paper Co.,*[3] supra, in that they involve the employment of a scientific truth to a new and useful end without attempting to control the use of the truth itself. As Mr. Justice Stone, writing for the Court in *Mackay Radio and Telegraph Co. v. Radio Corporation of America,* 306 U.S. 86 (1939),[4] stated (306 U.S. at 94):
>
> > While a scientific truth, or the mathematical expression of it, is not patentable invention, a novel and useful structure created with the aid of knowledge of scientific truth may be.
>
> "Though he spoke of structure the same is true of a process and the reasoning applies with equal force. The claims here at issue are not, as the PTO asserts, directed to an improved method of calculation for the cure time of rubber articles; such a conclusion is only made possible by ignoring the fact that a molding

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[2]102 U.S. 707 (1881).
[3]261 U.S. 45, 43 S.Ct. 322 (1922).
[4]Also 59 S.Ct. 427 (1939).

> press is recited and operates as the heart of the process." (Petition, Appendix A, 15a *et seq.* 602 F.2d at 988) (emphasis in original).

A basic error in the Petition is that Petitioner chooses to disregard the text of the *claims* in issue (and the claims *are* the issue) and attempts to force the present invention into the same form and even into the very words of Flook's claim in *Parker v. Flook,* 437 U.S. 584, 98 S. Ct. 2522, 57 L.ed.2d 451, 198 USPQ 193 (1978). Petitioner's attempt is completely improper. Respondents' invention is not like Flook's invention. Respondents' own claims are at issue here—not Respondents' claims recast by Petitioner in a Flook mold—and are what must be measured against Section 101. Petitioner cannot base its case on claims that Petitioner has written.

To grant certiorari and consequently to address an issue not actually in *this* case would only result in dicta or an advisory opinion, not in a true decision, and is contrary to Rule 19 of this Court. The actual issues are simple. They were correctly decided below and do not deserve the attention of the Supreme Court.

2. The Decision Below Is a Correct Application of the Law as Enunciated in Gottschalk v. Benson and Parker v. Flook

The Petition implies that the Court of Customs and Patent Appeals has failed to abide by this Court's prior decisions, and that it "refused to apply the analysis of patent claims required under *Parker v. Flook.*" (Petition for Certiorari, page 6). Such is not the case.

The CCPA carefully considered *Parker v. Flook, supra.* The CCPA opinion refers to *Parker v. Flook* by name on fourteen occasions—in the sections entitled "The Rejection" and "Appellants' Arguments" as well as on nearly every page in the section entitled "OPINION". After the CCPA carefully examined Diehr's application in the light of *Parker v. Flook,* it concluded that the present case did not involve claims for an improved method of calculation and that the instant claims were not directed essentially to a method of calculating:

> "It would be a gross distortion to say that the claims on appeal are directed essentially to calculations. In *Flook,* by contrast, the claims recited nothing but the calculation, coupled with the post-solution activity consisting only of updating an alarm limit to the newly-calculated value which is merely a new number. Here, the calculation is intimately entwined with the rubber molding process recited. Therefore appellants are not claiming a process for merely generating a new number by calculation." (Petitioner's Appendix A, p. 17a, 602 F.2d at 989).

The CCPA also gave careful consideration to *Gottschalk v. Benson,* 409 U.S. 63, 93 S. Ct. 253, 34 L.ed.2d 273, 175 USPQ 673 (1972), considering it at length early in its opinion and later in connection with *Parker v. Flook.*

The CCPA noted that both *Flook* and *Benson* reject the notion that computer programs are *per se* unpatentable. For example, *Gottschalk v. Benson* states "It is said that the decision precludes a patent for any program servicing a computer. We do not so hold." (409 U.S. at 71). Basically, *Gottschalk v. Benson* held that algorithms *per se* are not patentable and that a process which is purely

mathematical is not patentable because it does not fall within section 101. In the Court's own words:

> "It is conceded that one may not patent an idea. But in practical effect that would be the result if the formula for converting BCD numerals to pure binary numerals were patented in this case. The mathematical formula involved here has no substantial practical application except in connection with a digital computer, which means that if the judgment below is affirmed, the patent would wholly pre-empt the mathematical formula and in practical effect would be a patent on the algorithm itself." (409 U.S. at 63, 175 USPQ at 676)

Parker v. Flook says, "Yet it is equally clear that a process is not unpatentable simply because it contains a law of nature or a mathematical algorithm. See *Eibel Process Co. v. Minnesota and Ontario Paper Co.*, 261 U.S. 45; *Tilghman v. Proctor*, 102 U.S. 707" (437 U.S. at 590, 98 S. Ct. at 2526). The Court added: "Mackay Radio[5] and Funk Bros.[6] point to the proper analysis for this case: The process itself, not merely the mathematical algorithm, must be new and useful." (Idem.)

In the present case, the chemical-mechanical process is new and useful, but the "algorithm" is the very old Arrhenius equation, which continues to remain in the public domain for all to use. Thus, the present claims describe a process that is clearly patentable under both *Flook* and *Benson*; the CCPA's decision is completely consistent with those cases and follows their rules.

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[5]*Mackay Radio & Telegraph Co. v. Radio Corporation of America*, 306 U.S. 86, 40 USPQ 199 (1939).

[6]*Funk Bros. Seed Co. v. Kalo Co.*, 333 U.S. 127, 76 USPQ 280 (1948).

The present chemical-mechanical process starts with uncured rubber and ends with a precisely cured precision-molded product. Heretofore, rubber molds were kept closed for too short a period or for too long, so that the products were usually either undercured or overcured. The present technological invention provides for completely accurate cure, so that no time is wasted in overcure, and up to 25% more production is achieved with exactly the same molds. Rejection rates were formerly high; now they are virtually zero.

The present process utilizes a computer, as one of several tools, to perform the necessary repetitive calculations as one step of the process to determine accurate cure time. The computer is used in conjunction with instruments for reading the actual mold temperature every few seconds. Heretofore, the Patent and Trademark Office has granted patents on such technology, even when using computers. Examples include the two patents appearing in the Petition, Appendices F and G.[7] The Gould et al. patent 3,718,721 was granted in 1973, and the Davis et al. patent 3,649,729 was granted in 1972; both patents disclose calculating cure time with computers and each lists the same equation, in a somewhat different form, as that used herein.

The CCPA has conscientiously followed this Court's decisions in patent cases involving computer-related claims and technology. Respondents have endeavored to survey cases involving computer-related claims and technology which have come before the CCPA, and have come up with

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[7]These patents are not in the record of this case, and their citation at this time as prior art to be considered is most improper. Appendices F and G should be stricken.

the following results (as of January 9, 1980). Thirty-six cases concerning computers were analyzed, which represented all computer CCPA patent cases in which the Supreme Court had no part. Of these, the scope of patentable subject matter under 35 U.S.C. § 101 was considered in fourteen reported cases, not counting the present case or the *Bradley* case, infra. The applicable Supreme Court decisions were considered in every single one of those opinions.[8] Seven decisions affirmed the Board,[9] while seven reversed.[10] A review of those opinions reveals the great pains which the judges of the court below have used in analyzing and applying the appropriate cases and principles. The CCPA has steadfastly defended the Supreme Court decisions from seriously flawed misinterpretations advocated by the Board and Petitioner. As the court held

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[8]Some of those opinions were issued before Flook was decided, and therefore it was not cited therein.

[9]Cases affirming Board rejections and applying Flook and/or Benson:

In re Maucorps, 609 F.2d 481, 203 USPQ 812 (CCPA 1979);
In re Gelnovatch, 595 F.2d 32, 201 USPQ 136 (CCPA 1979);
In re Sarkar, 588 F.2d 1330, 200 USPQ 132 (CCPA 1979);
In re Richman, 563 F.2d 1026, 195 USPQ 340 (CCPA 1977);
In re de Castelet, 562 F.2d 1236, 195 USPQ 439 (CCPA 1977);
In re Waldbaum, 559 F.2d 611, 194 USPQ 465 (CCPA 1977);
In re Christensen, 478 F.2d 1392, 178 USPQ 35 (CCPA 1973).

[10]Cases reversing Board rejections and applying Flook and/or Benson:

In re Phillips, 608 F.2d 879, 203 USPQ 971 (CCPA 1979);
In re Johnson, 589 F.2d 1070, 200 USPQ 199 (CCPA 1978);
In re Toma, 575 F.2d 872, 197 USPQ 852 (CCPA 1978);
In re Freeman, 573 F.2d 1237, 197 USPQ 464 (CCPA 1978);
In re Deutsch, 553 F.2d 689, 193 USPQ 645 (CCPA 1977);
In re Chatfield, 545 F.2d 152, 191 USPQ 730 (CCPA 1976) cert. denied, 434 U.S. 875 (1978);
In re Noll, 545 F.2d 141, 191 USPQ 721 (CCPA 1976) cert. denied, 434 U.S. 875 (1978).

in *In re Johnson*, 589 F.2d 1070, 1081, 200 USPQ 199, 210 (CCPA 1978):

> "There is no reason for the Solicitor or the PTO to shortcut the analytical framework set forth in *Benson, Flook*, and decisions of this Court by relying on *unfounded generalities.*" (emphasis added.)

3. A Patent Claim Drawn to Subject Matter That is Otherwise Patentable Under § 101 Does Not Become Unstatutory Merely Because a Computer Is Involved

This Court has so far attached no special significance to the presence or absence of a "computer." It *has* found significance in whether an applicant is attempting to patent a "law of nature" or a "mathematical algorithm." For example, in the *Mackay Radio* case, the *Eibel* case and *Tilghman v. Proctor*, all referred to with approval in *Parker v. Flook*, it was held that the mere presence of a law of nature or a mathematical algorithm does not render an otherwise patentable process claim unpatentable. Respondents submit, as was found by the CCPA below,[11] that the presence of a "computer" is no more significant than the presence of an algorithm or a law of nature. Thousands of patents have been issued on the basis of such cases as *Mackay* and *Eibel* and *Tilghman v. Proctor*, all *supra*, including two patents that Petitioner includes in Appendices F and G to his Petition. In fact, all patentable

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[11] ". . . we do not find either the presence or absence of computer-related recitations in a claim to be of any significance. If the claim is drawn to a mathematical algorithm, formula, or method of calculation, it is nonstatutory whether it recites that a computer, an abacus, or a pencil and paper are used to make the calculations. The statutory nature of a process or method does not depend, under § 101, on the means used to carry it out." (Petition Appendix A, p. 14a, 602 F.2d at 987)

inventions are in accord with laws of nature, whether or not the claims specifically state the law or laws.

Respondents' recitation of the old and well-known Arrhenius equation does not remove the equation from the public domain or make this case different from those earlier cases reciting the same equation where patents were issued. In *Parker v. Flook* it was admitted that the equation was the *sole* basis for the argument of patentability, but in the present case the chemical and mechanical process steps are relied on for patentability of each claim considered as a whole. The CCPA correctly held that the claimed process is a "process" under Section 101, *whether or not* an equation or a computer or both are involved:

> "A claim drawn to a process or method does not depend for its validity under 35 U.S.C. § 101 on whether a computer is involved. If the claim is drawn to subject matter, *which is otherwise statutory,* it does not become non-statutory merely because a computer is involved in its execution. Thus, the fact that it may be said that an invention is drawn to a computer program or involves a computer is an observation which does nothing to aid in the determination of compliance with § 101." (Petition Appendix A, p.7a, 602 F.2d at 985 (CCPA 1979)) (emphasis in original).

Section 101 specifically includes the term "process," and in *Gottschalk v. Benson* this Court stated:

> "Transformation and reduction of an article 'to a different state or thing' is the clue to the patentability of a process claim that does not include particular machines" (409 U.S. at 70, 175 USPQ at 676).

Here, the new process certainly transforms a crude mass of uncured synthetic elastomer into a precision-

molded and cured product. Hence, the process is patentable. Moreover, such a process is not rendered unpatentable by its use of any particular machine, including a computer.

4. Considerations of Novelty and Obviousness Do Not Bear on Section 101

The statutory classes of invention named in 35 U.S.C. § 101 set forth the categories of inventions which may be patented, provided that they meet the other standards in the patent law. Section 101 is a threshold determination that in no way depends on novelty (35 U.S.C. § 102) or unobviousness (35 U.S.C. § 103). The CCPA said in its opinion below:

> "Considerations of novelty and obviousness have no bearing on compliance with § 101. Thus, the fact that certain limitations in a claim may be novel and certain others may be old is irrelevant to the outcome of this case." (Petition, Appendix A, p.13a, 602 F.2d at 987) (citations omitted).[12]

Each claim must be considered as a whole, but the Patent and Trademark Office failed to do so in considering the application at issue. The CCPA below correctly noted this additional error:

> "The PTO has separated the claim into old and new elements, ignoring the presence of the old elements in its analysis. Such reasoning is impermissible. The novelty or otherwise of any element or even of all the

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[12]The issues of novelty and of unobviousness are not before the Court. The Examiner did consider them and decided them in Respondents' favor. They are not in the record considered by the CCPA since they were not material to the § 101 issue. See also MPEP 707.07(g) "Piecemeal Examinations".

elements or steps, or of the combination has no bearing on whether the process is encompassed by § 101." (Ibid. at 16a and 988).

5. There Should Be No Consolidation With Diamond v. Bradley and Franklin

In its petition filed December 3, 1979 in *Diamond v. Bradley and Franklin*,[13] the Petitioner asked this Court to consider consolidating it for argument with this case. Such consolidation would confuse rather than clarify the issues.

The only common ground between these cases is that the Patent and Trademark Office improperly urges that the issue in both cases is whether computer programs can be patented under Section 101. Neither case actually raises that issue.

The cases have *very* little in common. The present case claims a mechanical-chemical *process*, and the claims contain a mathematical formula. The issue is whether claims to an otherwise statutory process become non-statutory claims merely because of the presence of a mathematical formula or merely because a computer is used in part of the process. *Bradley and Franklin* involves a *machine or apparatus*, specifically a computer; no mathematical formula is claimed or implied.

Even if certiorari be granted in both cases, the two cases are too different for *consolidation* of argument. Respondents therefore request that consolidation be denied.

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[13]The case below is *In re Bradley and Franklin*, 600 F.2d 807, 202 USPQ 480 (CCPA 1979).

CONCLUSION

The CCPA fully considered both the issues and the pertinent Supreme Court decisions, *Parker v. Flook* and *Gottschalk v. Benson.* It has properly applied those decisions to the issues, and correctly decided the case.

The Supreme Court's decisions in *Mackay Radio, Eibel,* and *Tilghman v. Proctor* are controlling; there is no conflict between those cases and *Flook* or *Benson.*

The *actual* issues at bar are run-of-the-mill. Nevertheless, the Patent and Trademark Office apparently wants to have this Court find otherwise and address questions which are not raised by the present case. Having made no attempt to claim a mathematical calculation, a computer program, or anything like one, Respondents seek to protect a process for precision molding of rubber. That process clearly lies within § 101, whether or not it uses a computer.

Respondents respectfully urge that the Petition for Certiorari be denied.

Respectfully submitted,

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No. 79-1112

IN THE

Supreme Court of the United States

October Term, 1979

SIDNEY A. DIAMOND, COMMISSIONER OF PATENTS AND TRADEMARKS, *Petitioner*

v.

JAMES R. DIEHR, II and THEODORE A. LUTTON

On Writ of Certiorari to the U. S. Court of Customs and Patent Appeals

BRIEF AMICUS CURIAE FOR THE AMERICAN PATENT LAW ASSOCIATION, INC. IN SUPPORT OF AFFIRMANCE AND/OR REMAND

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TABLE OF CONTENTS

	Page
I. AUTHORITY TO FILE	1
II. THE APLA AS A FRIEND OF THE COURT IN THE PUBLIC INTEREST	1
A. The Nature of the Amicus Organization	1
B. The Interest of Amicus is the Public Interest in Preservation of the Patent System	2
C. APLA Takes No Position on the Patentable Merits of the Invention Involved in This Application	2
III. PURPOSE OF THIS BRIEF	5
IV. COMMENT ON THE GOVERNMENT'S STATEMENT OF THE ISSUES BEFORE THE COURT	6
V. ARGUMENT	7
A. The Decision Below is Consistent with the Underlying Philosophy in *Benson* and *Flook* that only Practical Applications of Principles of Nature to Produce a Beneficial Result or Effect Should be Eligible for Patent Protection	7
B. The CCPA has Recognized and Applied this Philosophy Consistent with the Holdings in *Benson* and *Flook*	8
C. Where the Claimed Subject Matter as a Whole is Drawn to a Practical Application of a Principle of Nature in a Specific Manner to Produce a Beneficial Result or Effect in One of the Technological Arts, that Subject Matter Should be Eligible for Patent Protection Under § 101	16
D. Conclusion	20

TABLE OF AUTHORITIES

CONSTITUTION

Page

U. S. Const. art. 1, § 8, cl. 8 5

FEDERAL STATUTES

28 U.S.C. § 1542 (1976) 3
35 U.S.C. § 101 (1976) ..... *passim*
35 U.S.C. § 102 (1976) 4, 22
35 U.S.C. § 103 (1976) 4, 22
35 U.S.C. § 112 (1976) 4, 7, 22
35 U.S.C. § 144 (1976) 3

CASES

In re Alul, 468 F.2d 939 (CCPA 1972) 3
In re Arkley, 455 F.2d 586 (CCPA 1972) 3
In re Bergy, 596 F.2d 952 (CCPA 1979) 4
In re Christensen, 478 F.2d 1392 (CCPA 1973) 8, 19
In re de Castelet, 562 F.2d 1236 (CCPA 1977) 9, 19
In re Diehr, 602 F.2d 982 (CCPA 1979) 7, 20
In re Freeman, 573 F.2d 1237 (CCPA 1978)...12, 13, 15, 16, 19, 20
In re Gelnovatch, 595 F.2d 32 (CCPA 1979) 11, 19
Gottschalk v. Benson, 409 U.S. 63 (1972) ..... *passim*
Mackay Radio & Telegraph Co. v. Radio Corp. of America, 306 U.S. 86 (1939) 19
In re Maucorps, 609 F.2d 481 (CCPA 1979) 11
Parker v. Flook, 437 U.S. 584 (1978) ..... *passim*
In re Richman, 563 F.2d 1026 (CCPA 1977) 9, 10, 13-14, 19
In re Sarkar, 588 F.2d 1330 (CCPA 1979) 11, 19
In re Waldbaum, 559 F.2d 611 (CCPA 1977) 9
In re Walter, 618 F.2d 758 (CCPA 1980)...11, 14, 15, 16, 18, 19, 20

No. 79-1112

IN THE

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SIDNEY A. DIAMOND, COMMISSIONER OF PATENTS AND TRADEMARKS, *Petitioner*

v.

JAMES R. DIEHR, II and THEODORE A. LUTTON

On Writ of Certiorari to the U. S. Court of Customs and Patent Appeals

BRIEF AMICUS CURIAE FOR THE AMERICAN PATENT LAW ASSOCIATION, INC. IN SUPPORT OF AFFIRMANCE AND/OR REMAND

I. AUTHORITY TO FILE

This amicus brief is presented under Rule 36. The letters of consent are on file with the Clerk.

II. THE APLA AS A FRIEND OF THE COURT IN THE PUBLIC INTEREST

A. The Nature of the Amicus Organization

The American Patent Law Association, Inc. ("APLA") is a non-profit membership organization of over 4,000

lawyers interested in intellectual property law, that is, patents, trademarks, copyrights, trade secrets and related areas of law. Members of APLA not only practice before the Patent and Trademark Office ("PTO"), but also are concerned with patent litigation, with counseling on infrigement and validity matters, and with licensing or other transfer of patented and non-patented technology.

APLA membership is not restricted to any segment of the profession. Attorneys in private practice and those employed by corporations, universities and government are included. Members of the association and their clients represent widely divergent interests and views. They represent individuals, organized research and development (both academic and commercial), and large and small industrial and business enterprises.

B. The Interest of Amicus is the Public Interest in Preservation of the Patent System

The APLA has expertise in the day-to-day workings of, and the public benefits derived from, the American patent system. Since the broadly based association membership is not divided into plaintiffs' and defendants' bars, APLA is uniquely qualified to speak fairly on the general issues which affect the public interest in preserving the patent system.

C. APLA Takes No Position on the Patentable Merits of the Invention Involved in This Application

The jurisdiction of the Court of Customs and Patent Appeals ("CCPA"), in its review of the decisions of

the PTO tribunals, is limited.[1] This means that the CCPA decision in the case presently under review must *NOT* be considered as a conclusion that a patent should issue.[2] The CCPA decided *ONLY* that the PTO was wrong in rejecting all claims in the applications for being outside the categories of subject matter eligible for patent protection[3] as set forth in 35 U.S.C. § 101

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1. While 28 U.S.C. § 1542 states broadly that the CCPA "shall have jurisdiction of appeals from decisions of" the Patent and Trademark Office, the patent statute requires that the court "shall hear and determine such appeal on the evidence produced before the Patent and Trademark Office, *and the decision shall be confined to the points set forth in the reasons of appeal.*" 35 U.S.C. § 144 (1976) (emphasis added). The policy of the CCPA in this regard is well summarized in the following passage from *In re Alul,* 468 F.2d 939, 941 (CCPA 1972):

> We note that a substantial part of the solicitor's brief is devoted to arguments which were not raised below and which are tantamount to new grounds of rejection. The practice of raising such matters at this stage of the prosecution is unfair to the other party, adds to the burden of the court, and serves to obscure the raising party's position on the issues that actually were raised below. We will not consider these new arguments. We realize the position this leaves appellants in, but we are confident that if any merit were found in the new arguments in cases like this, the Patent Office would reopen prosecution to assert them and give appellants a chance to respond to them.

2. "It is the Patent Office which grants patents, not this Court." *In re Arkley,* 455 F.2d 586, 589 (CCPA 1972).

3. It is critical that the Court understand the distinction we make in this brief between the issue of whether claimed subject matter *is eligible for patent protection,* on the one hand, and the issue of whether claimed subject matter *satisfies the conditions for patentability, i.e.,* is new, useful and nonobvious, and thereby merits the grant of a patent, on the other hand. It is the former issue only which is before the Court because that is the only ground on which the PTO chose to finally reject the application here involved and the application in the companion case, *Diamond v. Bradley* (No. 79-855). The APLA agrees that inquiry as to either issue must consider the claimed subject matter *in its entirety,* but emphasizes that each inquiry must be made separately and independently of the other.

(1976). No other issues were before the CCPA. In each case the agency chose not to pursue any other ground for rejection, and that court thus could not consider questions related to the novelty or nonobviousness of the claimed subject matter.

The APLA believes that value judgments as to whether these respondents should or should not ultimately be *entitled to* a patent[4] have no proper place in deciding whether the subject matter which respondents seek to have patented is *within the statutory categories which are eligible for* the patent grant. While taking no position on whether the application now before the Court satisfies the various statutory requirements and conditions for patentability,[5] the APLA fully supports the holding of the CCPA that the claims of this application define subject matter which is eligible for patent protection under § 101 of the statute.

Cf. In re Bergy, 596 F.2d 952, 959 (CCPA 1979), wherein the CCPA expressed its concern regarding the

> commingling of distinct statutory provisions which are conceptually unrelated, namely, those pertaining to the *categories* of inventions in § 101 which *may* be patentable and to the *conditions* for patentability demanded by the statute for inventions within the statutory categories, particularly the nonobviousness condition of § 103.

4. We are concerned that the apparent relative simplicity of the Diehr and Lutton invention, coupled with the manner in which the government has developed its argument, may persuade some justices that the CCPA ruling should be reversed simply on the ground that a patent ought not to issue on this particular application. Alternatively, some might conclude that to affirm the ruling of the CCPA will result in the issuance of many patents where the only novelty of the invention involved lies in the use of a programmed computer. We urge the Court to be clear that an affirmance of a CCPA decision does not mandate that even the application which is before the Court issue as a patent.

5. 35 U.S.C. §§ 102, 103 and 112 (1976), in particular.

III. PURPOSE OF THIS BRIEF

The public interest in an effective patent system demands a broader view of the issues than that provided by the petitioner, which appears to be largely reflective only of administrative problems in the PTO.

The government's briefs urge an approach to claim analysis — having potential application beyond the specific area of computer program-related inventions — which could severely undermine the patent system itself.

The government seeks in this case, as it did in *Gottschalk v. Benson,* 409 U.S. 63 (1972), and *Parker v. Flook,* 437 U.S. 584 (1978), and as it does in *Diamond v. Bradley* (No. 79-855), to have the Court foreclose the granting of patents for all inventions involving computer programming. This attempt is at odds with the constitutional purpose behind our patent system, *i.e.,* "to promote the Progress of . . . the useful Arts."[6] In this technology, as in all others, it is a socially desirable goal, effectively implemented by our patent system, to induce and to encourage by patent grant the disclosure of new and useful information and the commitment of capital to research and development.

In its brief to this Court, the government accuses the CCPA of "summarily dismissing" (Pet. Br. at 10) the majority opinion in *Flook,* and following the approach of the dissenting opinion in refusing "to identify and set aside, as had the Board, those steps in the claim that were old in the art" (*id.* at 5), and to "identify respondents' computer program as the only novel feature of

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6. U.S. Const. art. 1, § 8, cl. 8.

their invention" (*id.* at 11). The CCPA's decision that respondents' claims recited statutory subject matter comports, says the government, with that court's persistent criticism of *Flook*" (*id.*, citing a single opinion).

It is a major purpose of this brief to persuade the Court that the decision of the CCPA in this case is *not* inconsistent with the holdings in *Benson* and in *Flook*. Rather, it is based upon a reasoned approach, consistent with those cases and with the aims of the patent system, whereby claimed subject matter involving computer-related or mathematics-related concepts may be tested to determine whether it is eligible for patent protection.

IV. COMMENT ON THE GOVERNMENT'S STATEMENT OF THE ISSUES BEFORE THE COURT

The Petition in this case presents the question as:

> Whether a computer program that regulates the curing time of rubber products in a mold is patentable subject matter under 35 U.S.C. 101.

This question suggests that the application before the Court is seeking to patent a computer program, which could not be further from the truth. We ask the Court to compare "the question" presented with the actual language of the application claims. Respondents here are not claiming a "computer program." In fact, respondents have pointed out not only that they are *not* claiming computer programs, but also that they have never intended to do so.[7] Nor did the CCPA, in reversing

7. For more than 100 years the patent statutes have required each patent applicant to "particularly point out and distinctly claim

the decision of the PTO, determine the subject matter of this application to be a computer program.[8]

It is a fact, however, that the invention of these claims *does* require, in its practical application, the *use* of a programmed computer, and the claims now before the Court make reference to this fact. The question presented by the government, however, focuses on this point alone, through an exercise which ignores what the patent applicants are seeking to patent and what the court below found to be defined by the application claims. The "how" and "why" of this exercise, its basic impropriety, as well as its insidious danger to the constitutional underpinnings of our patent system, is the principal focus of APLA's brief in *Diamond v. Bradley,* No. 79-855, filed concurrently herewith.

V. ARGUMENT

A. The Decision Below is Consistent with the Underlying Philosophy in Benson and Flook that only Practical Applications of Principles of Nature to Produce a Beneficial Result or Effect Should be Eligible for Patent Protection

In our brief in *Diamond v. Bradley,* No. 79-855, filed concurrently herewith, we set forth the Association's position that a rational philosophy can be found, underlying the decisions in *Benson* and in *Flook,* which is

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the subject matter he regards as his invention." This requirement continues in the present statute in the second paragraph of 35 U.S.C. § 112 (1976).

8. The CCPA characterized the claimed invention as "a method for operating molding presses used in the manufacture of rubber articles." *In re Diehr,* 602 F.2d 982, 983 (CCPA 1979).

consistent with past decisions of this Court and which supports the constitutional goals of our patent system. We further point out that the artificial "two-step" approach to claim analysis proposed by the government is not supported by this philosophy. Many predicates underlying the position we take in this brief are set forth in our *Bradley* brief and not repeated here. We urge the Court to read these two briefs together and consider the position we take in each as applicable to both cases.

The CCPA decision in the present case was based upon that court's focusing on the entirety of the claimed subject matter and concluding that, when so viewed, respondents' claims "were not essentially for a method of calculation or formula . . . but for an improved process . . . ." Pet. Br. at 11. As such, the decision below was entirely consistent with the philosophy we set forth in our *Bradley* brief.

In the remainder of this brief, we will outline the CCPA's eight-year, twenty-case "struggle" to develop an approach to claim analysis which is consistent with both the decisions in *Benson* and *Flook* and with the philosophy underlying those decisions.

B. The CCPA has Recognized and Applied this Philosophy Consistent with the Holdings in Benson and Flook

The CCPA quickly recognized the implications of *Benson,* and regularly applied them to affirm PTO decisions holding claimed subject matter non-statutory. The first of these post-*Benson* cases was *In re Christensen,* 478 F.2d 1392 (CCPA 1973), wherein the claimed invention was for a method of determining the porosity

of an underground formation. The recited method involved a computation step using a newly-developed mathematical equation which was to be solved to compute the porosity of the formation after values for the parameters to be used were established according to antecedent steps admittedly old in the art. The CCPA affirmed the PTO's decision rejecting these claims as non-statutory subject matter. That court concluded that the addition of old and necessary antecedent steps of establishing values for the variables in a newly discovered mathematical relationship would not convert an otherwise non-statutory mathematical algorithm into statutory subject matter.

Subsequently, in *In re Waldbaum,* 559 F.2d 611 (CCPA 1977), *In re de Castelet,* 562 F.2d 1236 (CCPA 1977) and *In re Richman,* 563 F.2d 1026 (CCPA 1977), the court continued to apply and to extend the holding in *Benson,* affirming the rejection, as non-statutory subject matter, of claims which clearly recited and preempted mathematical algorithms in the abstract. In *Waldbaum,* the court made clear that it would not consider the mere recitation, in the preamble of the claim, of an intended end use or environment of application for the algorithm to affect the basic non-statutory nature of the claim. In *de Castelet,* the claimed method was expressly stated to be machine-implemented, but was held to be nothing more than the calculation of a mathematical algorithm. In analyzing the rationale of *Benson,* the court stated as follows:

> The type of problem facing the Supreme Court in *Morse, The Telephone Cases,* and *Benson,* was described by one commentator over a hundred years ago, as "how far a discovery or invention

> which may first disclose and practically embody some truth in physics or some law in the operation of the forces of nature, for a useful purpose, is capable of being carried in the exclusive privileges secured by the grant of letters patent," Curtis, A Treatise on the Law of Patents for Useful Inventions § 124 (4th ed. 1873). Recent authority is in accord. See 1 Deller's Walker on Patents § 23 (1964).
>
> It is thus clear that the "nutshell" language of *Benson* expressed the ancient rule that *practical application remains the key*. Because it did not consider the performance of an algorithm by a computer as constituting a practical application of that algorithm under the rule, the Court must have viewed Benson's claims as effectively claiming the "effect," principle, or law or force of nature (the algorithm) itself.

562 F.2d at 1243 (emphasis added). In an earlier footnote, the court had pointed out that

> it is important to distinguish between situations in which (1) the scientific truth per se constitutes the sum of the subject matter sought to be patented, and (2) the scientific truth is merely used in an overall process or to describe a physical relationship.

562 F.2d at 1241n.3.

In *Richman,* the court again found a preamble recitation of an intended end use application, limiting the mathematical algorithm recited in the claims to a particular environment, insufficient to change the fact that the claim in its entirety was drawn to a mathematical expression of scientific truth. "The decisive factor is whether a claimed method is essentially a mathematical calculation." 563 F.2d at 1030. This case is particularly

noteworthy because the claims in question were held non-statutory *even though* they included apparently new and nonobvious procedures for acquiring data for use in the mathematical formulae recited.

The CCPA has continued to apply *Benson* in the same manner, affirming rejections under § 101 in *In re Sarkar,* 588 F.2d 1330 (CCPA 1979), *In re Gelnovatch,* 595 F.2d 32 (CCPA 1979), *In re Maucorps,* 609 F.2d 481 (CCPA 1979) (wherein the court stated that *Benson* applies equally whether an invention is claimed as an apparatus or as a process), and, most recently, in *In re Walter,* 618 F.2d 758 (CCPA 1980).

Since this Court's decision in *Benson,* the CCPA has decided some twenty cases in which it addressed the issue of whether claims involving mathematical equations or computer programs were within the categories of patentable subject matter set forth in § 101. Each case presented an entirely different set of facts, some inventions involving complex subject matter (such as that involved in the Bradley and Franklin application) while others were more easily understood (such as in the Diehr and Lutton application). Chief Judge Markey in his dissenting opinion in *Gelnovatch* succinctly pointed out the problem that the CCPA has had in dealing with these cases:

> Efforts to follow precedent in "computer program" type cases require repeated wrestling with the interpretation and effect of such terms as "program," "mathematical formula," "algorithm," "solution," "equation," and "calculation." . . . In *Benson,* some of those terms were used interchangeably.

595 F.2d at 45.

While this Court was considering the *Flook* case, the CCPA came down with an opinion in which it suggested a reasoned approach, consistent with this Court's decisions in *Benson* and in prior cases, to determine whether a claim to computer program-related subject matter is eligible for patent protection under 35 U.S.C. § 101. In *In re Freeman,* 573 F.2d 1237, 1245 (CCPA 1978), that court stated the following two-step inquiry (not to be confused with the government's two-step approach):

(1) Does the claim directly or indirectly recite[9] an algorithm in the *Benson* sense of the term?

(2) Does the claim in its entirety wholly preempt that algorithm?

A negative response to either of the two questions would necessarily take the claim outside the *Benson* holding. Rejection of the claim on the ground that it defined non-statutory subject matter would thus be improper.

Step (1) of the *Freeman* test (Does the claim recite an algorithm?) recognizes that a claim cannot preempt a mathematical algorithm or law of nature unless it recites it. A claim which recites nothing more than a mathematical algorithm, as was said to be the case in *Benson,* or which clearly contains mathematical terms, is of course the easy case. However, the *Freeman* test also recognizes that a mathematical relationship or method of calculation may be implicit in the language

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9. The CCPA discussed its meaning of the word "recite" in *Freeman,* 573 F.2d at 1246:

> In some claims, a formula or equation may be expressed in traditional mathematical symbols. . . . Other claims may use prose to express a mathematical computation or to indirectly recite a mathematical equation or formula by means of a prose equivalent therefor.

of the claims even though the formula or mathematical relationship is not expressly recited in mathematical symbols. If the step (1) inquiry does not yield a "yes" answer, there is no need to proceed to step (2). The claim could never be an attempt to preempt a mathematical relationship if none is present. On that basis, the claim would be statutory.

Step (2) of the *Freeman* test was formulated in response to the mandate by this Court in *Benson*. A claim which "would wholly preempt the mathematical formula and in practical effect would be a patent on the algorithm itself" is not patentable subject matter within the meaning of § 101. 409 U.S. at 71. Thus, the inquiry of step (2) of the test it to determine if the claim in practical effect wholly preempts the mathematical algorithm or relationship found in step (1).

The CCPA continued to approach the issue of whether a computer-related claim defined statutory subject matter by means of this so-called *Freeman* analysis, even after this Court handed down its decision in *Flook*.

In its first considerations of *Flook*, the CCPA apparently viewed the holding in that case as coming under step (2) of the *Freeman* analysis. That is, the CCPA considered the holding in *Flook* to be an affirmation of the correctness of its pre-*Freeman* decision in *In re Richman, supra*, wherein the court held that a method of calculating values for parameters to be used in a mathematical relationship was non-statutory despite the recitation in the claim preamble that the relationship was to be applied in an airborne doppler radar system.[10] Applica-

10. In *Richman* the CCPA stated that "if a claim is directed essentially to a method of calculating, using a mathematical formula,

tion of step (2) of the analysis consistent with the *Flook* opinion became impossible in all situations, however, so the CCPA refined its *Freeman* analysis to bring it more in line with the holding in *Flook,* while at the same time keeping the analysis consistent with its own past decisions and especially with prior holdings of the Supreme Court. In *In re Walter,* the CCPA held:

> Once a mathematical algorithm has been found, the claim *as a whole* must be further analyzed. If it appears that the mathematical algorithm is implemented in a specific manner to define structural relationships between the physical elements of the claim (in apparatus claims) or to refine or limit claim steps (in process claims), the claim being otherwise statutory, the claim passes muster under § 101. If, however, the mathematical algorithm is merely presented and solved by the claimed invention, as was the case in *Benson* and *Flook,* and is not applied in any manner to physical elements or process steps, no amount of post-solution activity will render the claim statutory; nor is it saved by a preamble merely reciting the field of use of the mathematical algorithm.

618 F.2d 758, 767 (CCPA 1980) (footnotes omitted). This analysis comes from a recognition that the issues under §101 in the area of computer-arts inventions "have arisen because the function of the computer has been to perform mathematical operations." *Id.* at 764. As the CCPA now[11] sees it:

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even if the solution is for a specific purpose, the claimed method is non-statutory." 563 F.2d at 1030. Compare this with *Flook,* 437 U.S. at 595n.18 and accompanying text.

11. *In re Walter,* 618 F.2d at 764.

> In the computer arts, § 101 problems tend to center around the use of mathematics in the claims, which define the invention for which patent protection is sought. This is a natural consequence of the nature of computers. A computer is nothing more than an electronic machine. It is characterized by its ability to process data, usually by executing mathematical operations on the data at high speeds. By virtue of the speed with which computers operate, they are capable of executing complex or otherwise time-consuming calculations in fractions of a second. Their use in technology is analogous to the use of mechanical devices, such as levers, which provide mechanical advantage in inventions of a mechanical nature; they make possible, or practicable, the solution of mathematical problems which are impractical to solve manually due to the inordinate amount of time manual solution would consume.

The CCPA's recognition that most of the problems with regard to computer-related inventions stem from the mathematical nature of the subject matter makes it even more apparent how that court sees *Benson* and *Flook* as consistent with prior Supreme Court precedents speaking on the application of the patent laws to newly discovered natural principles. *Benson, Flook,* and the CCPA's *Freeman-Walter* analysis thus hold that pure mathematical relationships are nothing more than natural phenomena, which they say should not be the subject of patent protection — even if those relationships have never been discovered or appreciated before and despite their having to be implemented by an incredibly rapid machine. Claims which attempt to wholly preempt such a newly-discovered mathematical relationship, either directly or indirectly, are thus seen to take from the

public a right which it would otherwise be entitled to enjoy. Even when the claim recites a specific technological environment of use, the *Freeman-Walter* analysis would require it to do more than simply present the mathematical relationship and solve it (or otherwise perform some mathematical exercise with it) in order to satisfy § 101. Computer implementation of the mathematical calculations, without more, is not seen as that implementation or application of the scientific principle to a readily ascertainable and specific practical end use for which the patent system was constitutionally created.

On the other hand, the mere fact that a mathematical relationship is recited, even if it is the only point of novelty in the claim, and even if it can only be practically implemented by computer, should not remove a claim from eligibility for patent protection *if that claim otherwise is drawn to a practical application or implementation of the mathematical relationship to produce a specific beneficial result or effect in one of the technological arts.*

C. Where the Claimed Subject Matter as a Whole is Drawn to a Practical Application of a Principle of Nature in a Specific Manner to Produce a Beneficial Result or Effect in One of the Technological Arts, that Subject Matter Should be Eligible for Patent Protection Under § 101

Computer program-related cases decided by this Court and by the CCPA can be categorized according to the nature of their claims as follows:

(1) Claims directed at preempting mathematical algorithms which are to be implemented on a pro-

grammed computer or for which computer implementation is the only practical application; and

(2) Claims which recite the *use* of a programmed computer in carrying out one or more steps in a process claim, or performing the function of one or more of the elements of an apparatus claim.

As a result of those prior decisions of this Court and of the CCPA, the subject matter of inventions found to be in class (1) above will always be non-statutory. But for inventions in class (2) above, the matter will never be so clear-cut. In this category, there is no clear dividing line separating subject matter which is eligible for patent protection from that which is not. The Court previously acknowledged this fact when it said, "The line between a patenable 'process' and an unpatentable 'principle' does not always shimmer with clarity." *Flook,* 437 U.S. at 589.

What then, in terms of 35 U.S.C. § 101, is a *permissible* use of a principle of nature—the recitation of which in a patent claim will "transform an unpatentable principle into a patentable invention"? It is only when that inquiry is on the entirety of *what* is protected by the claim that that question can be answered. Focusing on exactly *what* is protected by the claim will permit further inquiry into how each element (step) interacts with the other elements in the claim to define the function performed by the invention. Understanding this interaction will better enable the determination of whether or not the claim is seeking to protect the principle itself.

The Court in *Benson* and *Flook* dealt only with computer-implemented mathematical algorithms. The claim in *Benson,* directed to all uses of the BCD-to-Binary con-

version method, was held to be an attempt to preempt in its entirety the algorithm itself. The claim in *Flook* was held to cover essentially nothing but a mathematical exercise, the end product of which was a pure number. Neither of those cases holds or requires that a claim be rendered non-statutory simply because a mathematical algorithm is involved.[12] We submit that this is because the Court, in those two cases, implicitly recognized that claims which are not merely directed to a principle of nature (of which mathematical expressions or algorithms are but one kind), but rather are directed to a specific, beneficial end use of the principle,[13] must be considered as proper subject matter for patent protection. Thus, any inquiry into statutory subject matter within the meaning of § 101 must consider the claimed subject matter in its entirety in order to determine if a principle of nature is being applied in a specific manner to achieve a beneficial result in the technological arts.

In *Walter, supra,* the CCPA addressed the difference in the preemption requirement between the *Benson* and the *Flook* holdings by restating the second step of the *Freeman* test in terms other than preemption. As restated in *Walter,* 618 F.2d at 767, the CCPA's test now asks:

(1) Does the claim directly or indirectly recite an algorithm in the *Benson* sense of the term?

(2) If the answer to step (1) is yes:

(a) Does the mathematical algorithm, which is implemented in the specific manner, define a

12. "Yet it is equally clear that a process is not unpatentable simply because it contains a law of nature or a mathematical algorithm." *Flook,* 437 U.S. at 590.

13. Such as, for example, the computer-controlled improved automobile carburetor which is referred to in our *Bradley* brief.

structural relationship between the physical elements of the claim (in apparatus claims) or refine or limit claim steps (in process claims), or

(b) Is the mathematical algorithm found in step (1) merely presented and solved by the claimed invention and not applied in any manner to physical elements or process steps?

The CCPA's *Freeman-Walter* approach appears to be a workable one. Under this analysis, claims which define nothing but the mathematical algorithm, as in *Benson*, even those which define a specific technological environment of intended application, such as those in *Waldbaum*, *de Castelet*, and *Walter*, will be immediately rejectable. Those which include preliminary determinations of values (*Christensen* and *Richman*) and which essentially do nothing more than calculate, solve, compare or correlate according to the mathematical relationships set forth (such as in *Christensen*, *Flook*, *Richman*, *Sarkar* and *Gelnovatch*) will similarly fail to define subject matter eligible for patent protection.

On the other hand, claims which include the required *application* of a principle to obtain a beneficial result should clearly meet the test to define statutory subject matter. Such claims might, for example:

> *Employ* a mathematical principle or algorithm *to define a structural relationship* between one or more physical elements of the claimed subject matter (as the mathematical expression for the angular separation of the antenna elements in *Mackay Radio*);[14] or

14. *Mackay Radio & Telegraph Co. v. Radio Corp. of America*, 306 U.S. 86 (1939).

> Employ a mathematical relationship *to define and limit the function* of one or more elements of a mechanical combination (such as the algorithm embodied in the firmware of the fourth means in *Bradley*) or one or more steps of a method (such as the Arrhenius equation for calculating the curing time for rubber products in *Diehr*);[15] or
>
> *Apply* the information or data obtained from the solution of the mathematical relationships involved, *in specific, defined subsequent steps,* to produce the required practical beneficial result or effect.

The *Freeman-Walter* analysis is in harmony with present statutory provisions and judicial decisions and is adequate to permit an analysis of all computer program-related inventions. We submit that it is a proper threshold approach to the § 101 inquiry. Most importantly, it requires a consideration of the invention as a whole, and does not artificially ignore claim language. As such, it is a most effective means to determine whether a claim which recites a mathematical algorithm or other phenomenon or principle of nature does so in a manner which would preempt *only* the use of the algorithm, phenomenon or principle in a specific manner to achieve a beneficial result or effect in one of the technological arts.

D. Conclusion

We have asked the Court to compare the "question" on which the government sought certiorari with the actual language used in the claims of the application before the

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15. As we more fully demonstrate in attached Appendix A, both the Bradley et al. and the Diehr et al. inventions, *as claimed,* satisfy this inquiry and, therefore, should be considered as within the statutory categories of inventions eligible for patent protection.

Court. If this question is presented by this case, it can only be through a process of analysis which *ignores* the clear language of the claims, *ignores* decades of customary procedure, and *ignores* a long legal history of repeated insistence by the CCPA on specific application of the statutory language of the patent code in making rejections of an applicant's claims for patent protection. If this question is presented, it can only be by a claim dissection process which uses the meat axe, not the probing scalpel—a process which destroys the basic framework of the claims and changes them beyond recognition.

The applicants here are not claiming a "computer program." Nor does this case involve any attempt to "word" a claim through use of the draftsman's skills to make it appear as if it is drawn to something else when it in fact covers nothing but a computer program. If these claims are considered in their entirety, it is clear that no "principle," or abstract proposition, will be preempted by any patent which may issue. Rather, what will be patented will be a very practical, very beneficial *application* of programmed data processors to produce a desirable, beneficial result in one of the technological arts. The disclosure of these types of inventions is precisely what our patent system was intended to encourage.

As we have shown in our brief in *Bradley,* the logic of the position being asserted by the government will result in a rule which could strike down many meritorious inventions and which could lead to the non-disclosure of previously unknown or unappreciated principles and phenomena of nature. This cannot be the intent of the Court.

The APLA urges the Court to recognize that the CCPA's reasoned approach to analyzing computer-re-

lated and mathematics-related claims is consistent with this Court's holdings in *Benson* and *Flook* and should be upheld. Patent claims involving computer programs can be analyzed according to the principles expressed in the existing case law from the CCPA and from this Court without having to rely on Congress to act.

The judgment below, in its holding that § 101 is not a proper basis for rejecting this application, should be affirmed. Additionally, or in the alternative, if the Court deems it appropriate, this case should be remanded to the PTO for further consideration, consistent with the Court's opinion, of any remaining questions under §§ 102, 103 and 112 of the patent statute.

Respectfully submitted,

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APPENDIX A

Both the Bradley et al. and Diehr et al. Inventions Should be Eligible for Patent Protection

Bradley

Claim 1 of the Bradley and Franklin application reads as follows:

1. In a multiprogramming computer system having a main memory, a central processing unit (CPU) coupled to said main memory, said CPU controlling the state of a plurality of groups of processes being in a running, ready, wait or suspended state, said computer system also having scratchpad registers being accessible to an operating system for controlling said multiprogramming computer system, a data structure for storing coded signals for communicating between said processes and said operating system, and said scratchpad registers, said data structure comprising:

(a) first means in said data structure and communicating with said operating system for storing coded signal indicative of an address for a selected one of said processes;	[the "RPW" word location in the system base]
(b) second means in said first means for storing coded signals indicating priority of said selected one of said processes in relation to others of said processes for obtaining control of said CPU when ready;	[the "PRI" field of the RPW word location of the system base]

(c) third means in said data structure and communicating with said operating system, for storing coded signals indicative of an address for a selected one of said plurality of groups of processes, and,	[the "J and G" table words of the system base]
(d) fourth means coupled to said data structure and said scratchpad registers, for generating signals causing the changing of information in said data structure and said scratchpad registers.	[the microcode for implementing the function of the switch system base instruction, stored as firmware in the control store of the CPU]

The combination claimed by *Bradley* comprises a first means (the RPW word) for providing the address of a selected process within a group of processes; a second means within the first means for specifying the priority of that selected process; a third means for providing the address of a selected group of processes that contains as one of its processes the selected process of the first means; and a fourth means—the firmware—for changing the data in the data structure (including the first, second and third means) and the scratchpad registers. The third means provides an address for the selected group of processes that contains the selected process that will be in the running state. The first means provides an address which will be used with the address of the third means to locate the starting address within the selected group of processes of the instructions that will be fed to the CPU execution circuits. The function performed by the fourth means is shown in the functional flow diagrams of Figures 15b and 15c.

To consider the subject matter patentability of this claim, the operations contained in the firmware of the fourth means must be considered as though they were positively recited in the fourth means of the claims. This does not constitute "reading in" a limitation to the claim that otherwise was not already contained therein, for this procedure is expressly permitted by § 112 ¶ 6 of the patent statute.

Step (1) of the *Freeman-Walter* analysis requires, considering the claim as a whole, a determination whether a mathematical algorithm is directly or indirectly recited in the claim.

It is clear that the first, second and third means of claim 1 do not recite or constitute a prose equivalent of a mathematical algorithm. The government has argued before the CCPA and in its Petition to this Court that the first three means of claim 1 in *Bradley* are hardware elements for storing coded digital information, and that these elements are old and well-known in the art. Thus, if a mathematical algorithm is to be found recited in claim 1, it must be embodied in the function performed in the microcode firmware of the fourth means.

We have previously pointed out that it is the government's position, and on this point we agree, that where a computer program is involved, "the *proper inquiry* is whether *the program* . . . expresses a phenomenon of nature, mental process or an abstract intellectual concept" (emphasis added). However, the government contends with the same breath that *Bradley's* program is nothing more than the expression of an "abstract intellectual concept" because it constitutes "a set of directions . . . for

the switching of data . . . *untied to any practical end use.*" *Bradley* Pet. at 12. We do not agree.

At most, the government could argue that the claim fails to particularly point out and distinctly recite the "practical end use" for the changing of data in the data structure. It is absurd to contend that the switching of data between the image system base and the system base to change the data in the data structure is an "abstract intellectual concept." Any person of ordinary skill in the multi-programming computer art will appreciate that changing the data in the system base and the scratchpad registers can affect the control of the execution of the processes. There is therefore a very "practical end use" implicit in the claim, although the beneficial end use could be better recited.

Looking to the function performed by the fourth means of claim 1 illustrated in Figures 15b and 15c of the application, it is evident that a transfer of the data in each image memory location to its corresponding system base memory location, including the updating of the contents of the scratchpad registers with the new G table word, J table word and the IPQW (internal process queue word; see Figure 6) from the image system base, is all that is performed. The government contended before the CCPA that multiplying by 16 the address in the G and J table word locations of the system base, prior to loading these addresses into the scratchpad registers, converted the functions performed by the firmware of the fourth means, and therefore, claim 1, into a mathematical algorithm in the *Benson* sense. With this, we cannot agree.

Multiplying the base data of the G and J table words by 16 is equivalent to shifting each bit of the base data

of those word locations four bit locations in the direction to increase the magnitude of the absolute address obtained thereby. The function of this address shift is dictated by the architecture of the machine, and is only incidental to the function intended by the microprogram. *Bradley* is not attempting to preempt base address changing by shifting the data four places to obtain a new address.

It is therefore clear that claim 1 does not recite, directly or indirectly, a mathematical algorithm. Step (1) of the *Freeman-Walter* two-step test is not satisfied. There is no need to proceed to step (2). So long as the claim is otherwise statutory, the claim cannot be "drawn to" a mathematical algorithm, since none is recited.

If non-mathematical, but otherwise abstract, algorithms are also to be included within this analysis, the *Bradley* subject matter would still be found statutory. Proceeding with the next portion of the inquiry, it becomes readily apparent that when considered as a whole each *Bradley* claim defines a specific, practical implementation of the abstract principle involved to define and limit both the structure and the function of the claimed subject matter so that it performs a very useful, valuable operation within the digital computer. Step (2) of the inquiry asks the question—is the abstract principle, such as the mathematical algorithm found in step (1), merely presented and solved by the claimed invention and not applied in any manner to physical elements or process steps? The answer to this question is clearly no. Any algorithm, mathematical or otherwise, contained in the firmware of the fourth means of claim 1, so interrelates with the other physical elements of the claim that it clearly defines a limited, specific and practical application of the algorithm

to produce a beneficial result or effect in one of the technological arts. Enabling the user programmer to transfer control of program execution in a multi-programming computer system by transferring an image base, altered by the user's computer program, to the system base and scratchpad registers is a very beneficial and practical application. Step (2) of the inquiry would be satisfied whether or not there is a mathematical algorithm in the fourth means of claim 1.

Diehr

Claim 1 of the Diehr and Lutton application is representative of the *Diehr* process:

1. A method of operating a rubber-molding press for precision molded compounds with the aid of a digital computer, comprising:

providing said computer with a data base for said press including at least,

natural logarithm conversion data (ln),

the activation energy constant (C) unique to each batch of said compound being molded, and

a constant (x) dependent upon the geometry of the particular mold of the press,

initiating an interval timer in said computer upon the closure of the press for monitoring the elapsed time of said closure, [elapsed time]

constantly determining the temperature (Z) of the mold at a location closely adjacent to the mold cavity in the press during molding, [measuring the temperature]

constantly providing the computer with the temperature (Z),

repetitively calculating in the computer, at frequent intervals during each cure, the Arrhenius equation for reaction time during the cure, which is [calculating the ideal cure time using the Arrhenius equation]

$$\ln v = CZ + x$$

where v is the total required cure time,

repetitively comparing in the computer at said frequent intervals during the cure each said calculation of the total required cure time calculated with the Arrhenius equation and said elapsed time, and [comparing for equivalence between elapsed time and ideal time]

opening the press automatically when a said comparison indicates equivalence. [opening mold when equivalence found]

The function performed in each step of the claimed method is clearly presented and there is no need here to elaborate.

Mathematical formulae and equations have long been recognized as expressions for principles of nature. There is no other answer to our inquiry under step (1) of the *Freeman-Walter* analysis but that claim 1 of Diehr recites a principle of nature in the form of a mathematical algorithm—the Arrhenius equation. Step (1) is therefore satisfied, and we proceed to the second step of the test.

The inquiry under step (2) of the test seeks to determine if the mathematical algorithm found in step (1)

is merely presented and solved by the claimed invention and is not applied in any manner to physical elements or process steps, or is the claim drawn to a limited, specific, and practical application of the mathematical algorithm to produce a beneficial result or effect in one of the technological arts. The Arrhenius equation is admittedly old and well known in the rubber molding art, and has long been used for calculating the ideal cure time for rubber compounds.

The Arrhenius equation is presented, solved and the solution used in claim 1 to achieve the intended result of the claimed process—opening the mold at the proper time to avoid under-curing or over-curing the rubber. Although each time the computer solves the Arrhenius equation a number is obtained, unlike *Flook,* that number is not the end product of the claim. Rather, this number is then compared to a time factor—the amount of elapsed time since the mold was closed—to determine if they are the same. If not, the process continues to monitor the temperature and to calculate the solution to the Arrhenius equation at each temperature reading. There can be no question but that the mathematical algorithm embodied in the Arrhenius equation is *used* within the claim such that the claim, in its entirety, is drawn to a specific, limited and practical application of the principle to achieve a beneficial result in one of the technological arts. The claim is not drawn to the mathematical algorithm itself, but applies the mathematical algorithm in a specific manner to process steps to achieve a beneficial result.

Step (2) of the test is thus satisfied, *i.e.*, although a mathematical algorithm is recited in the claim, the claim as a whole is not drawn to the algorithm, but constitutes a specific *use* of the algorithm to a practical, beneficial end. Therefore, under the *Freeman-Walter* two-step test, so long as the claim is not otherwise non-statutory, claim 1 of *Diehr* defines patentable subject matter within the meaning of § 101.

Supreme Court, U. S.
FILED
JUN 10 1980
MICHAEL RODAK, JR., CLERK

No. 79-1112

In the Supreme Court of the United States

OCTOBER TERM, 1979

SIDNEY A. DIAMOND, COMMISSIONER OF PATENTS AND TRADEMARKS, PETITIONER

v.

JAMES R. DIEHR, II, AND THEODORE A. LUTTON

ON WRIT OF CERTIORARI TO THE UNITED STATES COURT OF CUSTOMS AND PATENT APPEALS

BRIEF FOR THE PETITIONER

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INDEX

	Page
Opinions below	1
Jurisdiction	1
Question presented	2
Statute involved	2
Statement	2
Summary of argument	6
Argument:	
This case is not meaningfully distinguishable from *Parker* v. *Flook*, and like its predecessor involves process claims that recite unpatentable subject matter	6
Conclusion	14
Appendix	15

CITATIONS

Cases:

Bergy, In re, 596 F.2d 952	11
Flook, In re, 559 F.2d 21	7
Gottschalk v. *Benson*, 409 U.S. 63	4, 5, 12
Parker v. *Flook*, 437 U.S. 584	passim
Walter, In re, 205 U.S.P.Q. 397	12

Statute:

35 U.S.C. 101	2, 4, 6, 7, 8

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BRIEF FOR THE PETITIONER

OPINIONS BELOW

The opinion of the Court of Customs and Patent Appeals (Pet. App. la-18a) is reported at 602 F.2d 982. The opinion of the Patent and Trademark Office Board of Appeals (Pet. App. 20a-25a) and the opinions of the patent examiner (Pet. App. 26a-37a) are not reported.

JURISDICTION

The judgment of the Court of Customs and Patent Appeals was entered on August 9, 1979, and a timely

petition for rehearing was denied on October 18, 1979 (Pet. App. 19a). The petition for a writ of certiorari was filed on January 16, 1980, and granted on March 17, 1980 (J.A. 3). The jurisdiction of this Court is invoked under 28 U.S.C. 1256. *Gottschalk* v. *Benson*, 409 U.S. 63 (1972); *Dann* v. *Johnston*, 425 U.S. 219 (1976); *Parker* v. *Flook*, 437 U.S. 584 (1978).

QUESTION PRESENTED

Whether a computer program that regulates the curing time of rubber products in a mold is patentable subject matter under 35 U.S.C. 101.

STATUTE INVOLVED

35 U.S.C. 101 provides:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

STATEMENT

On August 6, 1975, respondents James R. Diehr and Theodore A. Lutton applied for a patent on a process using a computer for regulating the curing time of rubber products in a mold press (Pet. App. 38a, 41a).[1]

Rubber products produced in a mold press are cured in the press for a specified time (Pet. App. 39a–40a). The time needed to obtain a good cure depends in part on the temperature inside the press, which is regu-

---

[1] The invention is assigned to Federal-Mogul Corporation, Detroit, Michigan (Br. in Opp. 6).

lated by a thermostat (*ibid.*).[2] It is possible, using well-known time, temperature, and cure relationships, to calculate when to open the press and remove the cured product (*id.* at 39a, 49a). Nonetheless, uncontrolled variables present in the actual curing process make it difficult to determine accurate temperatures for purposes of doing the necessary computations. The time the press is opened while it is being loaded, for example, affects the temperature inside the press when it is first closed and thus influences the time it takes to heat the press to the desired temperature (*id.* at 39a). For this reason, industry practice is to calculate the cure time as the shortest time in which all parts of the product definitely will be cured, assuming a "reasonable amount of mold-opening time" during loading and unloading (*id.* at 40a). The disadvantages of this practice are that erring on the side of caution will usually lead to overcuring the rubber, while keeping the mold open for more than a "reasonable" time will often result in undercuring (*ibid.*).

Respondents' claimed invention employs a digital computer to overcome these drawbacks. Measurement of the temperature in the closed, heated press is made "continuously," for example, every ten seconds (Pet. App. 41a). These measurements are automatically fed into the computer (*id.* at 41a, 45a). For each new measurement, the computer recalculates the cure time in accordance with a well-known mathematical formula, the Arrhenius equation (*id.* at 41a–42a, 46a).

---

[2] The geometric configuration of the press and the viscosity of the rubber when it enters the press are also important factors in computing the cure time (Pet. App. 46a–47a, 48a, 49a).

When the recalculated cure time equals the actual time that has elapsed since the press was closed, the computer signals a device to open the press (*id.* at 42a, 45a). Respondents' claims describe both the method for operating the press using the computer and, more generally, the method for manufacturing molded articles, including the steps of putting rubber into the press, closing and heating the press, and opening the press to remove the molded product (*id.* at 44a-62a).

The patent examiner rejected the invention as drawn to nonstatutory subject matter under 35 U.S.C. 101 (Pet. App. 26a-37a). He concluded that those steps in respondents' claims that are "carried out by the computer under control of a stored program" constitute nonstatutory subject matter under *Gottschalk* v. *Benson*, 409 U.S. 63 (1972) (Pet. App. 28a, 33a-34a). The remaining steps—which relate generally to the method of manufacturing precision molded articles, such as to the opening, closing, and heating of the mold—the examiner found to be conventional (*id.* at 28a, 33a).

The Patent and Trademark Office Board of Appeals unanimously affirmed the rejection. The Board found that respondents' specification, while not listing a computer program as such, in fact contained a sufficient description from which a person of ordinary skill in the art could write a computer program (Pet. App. 21a-22a). Analyzing the claims, the Board found much that was either within the prior art, such as the constant measurement of the mold temperature, or that involved post-solution activity, such as the automatic opening of the press. The calculation recited in the

claims, observed the Board, shows that respondents' system employs an algorithm (*id.* at 22a–24a). The Board summarized: "[t]he only difference between the conventional methods of operating a molding press and that claimed * * * rests in those steps * * * which relate to the calculation incident to the solution of the mathematical problem or formula" (*id.* at 24a). The Board concluded that this calculation, respondents' "contribution," was a computer program of the kind that is nonstatutory under *Benson*, *supra*, and *Parker* v. *Flook*, 437 U.S. 584 (1978) (Pet. App. 24a).

The Court of Customs and Patent Appeals reversed. It agreed with the Board that the applicants had "disclosed a computer program" (Pet. App. 5a n.3), but it stated that this "does nothing to aid in the determination of compliance with § 101" (*id.* at 8a) and is not "of any significance" (*id.* at 14a). It held that this Court's analysis detailed in *Flook* was merely "a convenient vehicle" for finding the method of calculation in that case to be nonstatutory, and did not establish "a general test in determining compliance with § 101" (*id.* at 13a–14a n.6). Thus it refused to identify and set aside, as had the Board, those steps in the claim that were old in the art (*id.* at 13a–14a, 16a–17a), stressing that "[c]onsiderations of novelty and obviousness have no bearing on compliance with § 101" (*id.* at 13a). The court instead considered the claims "*as a whole*" (*id.* at 13a–14a, 15a) and found that they recite "a process or method for molding rubber articles" (*id.* at 15a), at whose "heart" is a molding press, not an equation or method of calculation (*id.* at 16a). Since this "process" constituted "an improvement over prior processes"

(*id.* at 15a) themselves patentable subject matter, the court below concluded that respondents' "process" was likewise patentable (*id.* at 15a–18a).

SUMMARY OF ARGUMENT

This case differs from *Parker* v. *Flook*, 437 U.S. 584 (1978), in no significant way. In both cases, applicants seek to patent a process the only novel feature of which is an algorithm embodied in a computer program. The primary difference between the two cases is in the manner in which the claims have been drafted: although Flook's claims focused on the algorithm and recited only minor post-solution activity, the claims here recite in general terms the entire conventional rubber molding process. That difference does not justify a different result—*Flook* was an interpretation of the scope of Section 101, it was not a guide to the drafting of claims.

ARGUMENT

THIS CASE IS NOT MEANINGFULLY DISTINGUISHABLE FROM *PARKER* v. *FLOOK*: LIKE THAT CASE, IT INVOLVES PROCESS CLAIMS THAT RECITE UNPATENTABLE SUBJECT MATTER

Parker v. *Flook*, 437 U.S. 584 (1978), involved claims to a computerized method of updating alarm limits in catalytic conversion processes whose only advance over conventional methods resided in a novel formula. See *Parker* v. *Flook*, *supra*, 437 U.S. at 585–586, 594. The Patent Office rejected the claimed invention on the basis that it was for a formula or algorithm that was unpatentable. *Id.* at 587. Emphasizing that the process claims "[did] not preempt the for-

mula or algorithm contained therein," the Court of Customs and Patent Appeals held that the claims were patentable under 35 U.S.C. 101. *In re Flook*, 559 F.2d 21, 23 (C.C.P.A. 1977). This Court reversed. It found the fact of the formula's nonpreemption immaterial (*Parker* v. *Flook*, *supra*, 437 U.S. at 589–590, 593), stressing instead the importance of determining initially "what type of discovery is sought to be patented" (*id.* at 593). To accomplish this, the Court first assumed the "algorithm * * * to be within the prior art" (*id.* at 594). Taking what remained in "the application, considered as a whole," the Court determined that all else was "well known" (*ibid.*).[3] Hence, the "application contain[ed] no claim of patentable invention" (*ibid.*).

This case is *Flook* revisited. The Board properly set aside the algorithm[4] in the claims, embodied in a computer program, finding it nonstatutory (Pet. App. 24a).[5] Since the computer program was respondents' sole "contribution" (*ibid.*), the remaining steps of re-

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[3]This included the "chemical process involved in catalytic conversion * * *, the practice of monitoring the chemical process variables, the use of alarm limits to trigger alarms, the notion that alarm limit values must be recomputed and readjusted, and the use of computers for 'automatic monitoring-alarming'" (*ibid.*).

[4]For definitions of "algorithm" and other technical terms used in this brief we refer the Court to our brief in *Diamond* v. *Bradley*, No. 79–855, to be argued in tandem with this case (J.A. 3). We are sending respondents a copy of our brief in *Bradley*.

[5]The Board was correct in treating the programmed algorithm as nonstatutory. See *Parker* v. *Flook*, *supra*, 437 U.S. at 594; Brief for Petitioner in *Diamond* v. *Bradley*, No. 79–855, at 11–19.

spondents' method being "conventional" or "post-solution in character" (*ibid.*; see Pet. App. 28a, 33a), the Board correctly concluded that the claims recited nonstatutory subject matter.

Respondents do not now dispute that, as the Board found, the following steps in their claims are well-known: (1) putting unmolded synthetic rubber in the molding press cavity; (2) closing the press; (3) opening the press; and (4) removing the article (Pet. App. 24a). Indeed, the only step of their method which they contend is novel is the one of continually measuring the temperature in the mold cavity (Br. in Opp. 7). The Board found, however, that this step was old (Pet. App. 24a), and the court below left the Board's determination standing (*id.* at 13a).[6]

Respondents argue (Br. in Opp. 7) that the Board's finding is wrong, but they have been unable to show clear error. In fact, ample evidence supports the Board's finding. Prior patents, cited by the examiner here (Pet. App. 30a), identify this step. Thus, in a patent issued to Gould and Davis on February 27, 1973, the inventors described a "method of controlling the state of cure" that involved in part "locating a temperature sensing probe at a predetermined site within the article, * * * monitoring the local temperature of said site as a function of time, computing therefrom the total state of cure of said part of the article as a func-

[6] Respondents imply that the court below decided this factual issue in their favor (Br. in Opp. 7). This is not so, however. It is true that the CCPA observed in passing that on this point it was "inclined to agree with appellants" (Pet. App. 13a). But the court did not reverse the Board because it found the issue had no "relevance" to a Section 101 inquiry (*ibid.*).

tion of time, and terminating the heat supply when a predetermined state of cure has been reached" (*id.* at 64a–65a).[7] The computation employed the Arrhenius equation (*id.* at 59a) and Gould and Davis suggested using "a digital computer" to monitor and calculate the state of the cure at "set intervals" (*id.* at 67a).[8] In an earlier application, Davis and Gould described a similar method using "a computer device" to determine the state of cure at time intervals by sensing the temperature "at at least two boundary surfaces of the article" (*id.* at 75a, 77a).[9] In neither patent specification, however, did the inventors provide a flow chart from which a computer program could be written, or the computer program itself.[10]

---

[7] The specification noted that the mold could be opened automatically "by actuation by the computer of a suitable device" (Pet. App. 68a).

[8] Claim 1 specifies one-minute intervals; claim 7 is more general referring to "regular intervals" (Pet. App. 71a, 72a). As an alternative the inventors proposed monitoring temperature "as a continuous function of time" and recomputing the change in cure state "at every instant" (*id.* at 67a–68a).

[9] It can be important with precision molded products, such as those produced by the process described by respondents, that the temperature sensing device leave no imperfection in the rubber. Hence, the device is not inserted into the rubber itself, but instead reads the temperature at the surface of the rubber article.

[10] A 1972 patent granted to Neugroschl, also cited by the examiner here (Pet. App. 30a), described the use of a digital computer to monitor the rubber curing process continuously and to compare the data obtained "against pre-determined stored acceptable ranges of values" (U.S. Patent No. 3,659,974 to Neugroschl, patented May 2, 1972, filed Aug. 6, 1968 at 1). Neugroschl's specification included a computer program with

Thus respondents' only inventive contribution, if there is one at all, is in actually programming the computer to control the already-known rubber molding process.[11] That is how the Board treated respondents' application (Pet. App. 24a). The Board recognized that since respondents' contribution was limited to the program and did not claim an improvement in the process itself, the case was indistinguishable from *Parker* v. *Flook*, *supra* (*ibid.*). There, as here, the application claimed the continuous measurement of a process variable, a programmed recomputation using a mathematical formula, and an adjustment based upon that recomputation. *Parker* v. *Flook*, *supra*, 437 U.S. at 585–586.[12] The Board, following the *Flook* analysis, recognized that *Flook* controls this case.

The court below refused, however, to apply *Flook*, summarily dismissing it on the basis that this Court never "meant to establish that analysis as a general test" (Pet. App. 14a n.6). Thus, the CCPA did not

---

which to carry out his invention (*id.* at 4). He did not, however, contemplate programming the computer to recompute the actual cure time and then to direct machinery to open the mold at the appropriate moment. We are lodging a copy of the Neugroschl patent with the Clerk of this Court.

[11] Respondents admit that their "application contains flow sheets from which a competent programmer can set up a program" (Br. in Opp. 7) but maintain that strictly speaking "the application does not disclose a computer program" (*ibid.*). In fact, as noted by the Board (Pet. App. 22a), respondents filed an amendment that attached an actual program written in Fortran (see our brief in *Diamond* v. *Bradley*, *supra*, page 7, note 4) from respondents' specification (App. *infra*, 18–19).

[12] Flook's method was if anything more novel than respondents'. He at least employed a novel formula (*Flook*, *supra*, 437 U.S. at 585–586); respondents' formula is old. Neither Flook nor respondents would preempt all use of the formula claimed.

identify respondents' computer program as the only novel feature of their invention (*id.* at 13a-14a), but focused instead on the claims "*as a whole*" (*ibid.*)—in accordance with the approach of the dissenting opinion in *Flook* (437 U.S. at 599-600). It concluded that, when so viewed, respondents' claims were not essentially for a method of calculation or formula (Pet. App. 14a) but for an improved process (*id.* at 15a-16a). Accordingly, the court held that they recited statutory subject matter.

The decision below comports with the CCPA's persistent criticism of *Flook* (see, *e.g.*, *In re Bergy*, 596 F.2d 952, 966 (1979)) and effectively confines *Flook* to its own facts. But nothing in the *Flook* opinion justifies reading the decision so narrowly.[13] *Flook* does not suggest that this Court's analysis was, as the CCPA would have it, merely "a convenient vehicle to highlight the fact that Flook's actual contribution to the useful arts was his new formula" (Pet. App. 13a n.6). On the contrary, there was no dispute that the formula was Flook's sole contribution; it was assumed to be so. *Flook*, *supra*, 437 U.S. at 588. The critical point is that the discovery of the programmed algorithm could not support Flook's patent unless there was "some other inventive concept in its application." *Id.* at 594. Here, too, since the programmed algorithm is respondents' only contribution, there being nothing else original in the claims, they should have been rejected by the CCPA on the authority of *Flook*.

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[13] Certainly, the dissenting Justices in *Flook* did not read the Court's opinion as being so limited. See *Parker* v. *Flook*, *supra*, 437 U.S. at 599.

The court below found it significant that respondents' claims "recite a process involving the manipulation of apparatus" while the *Flook* claims "recite nothing but the calculation, coupled with the post-solution activity consisting only of updating an alarm limit" (Pet. App. 17a).[14] But *Flook* cannot be read as turning on the manner in which the claims were drafted. Indeed, the Court there rejected a similar attempt to distinguish that case from *Benson* on the ground that the claims in *Flook* had been drafted to include "post-solution activity" in addition to the algorithm (437 U.S. at 590; footnote omitted):

> The notion that post-solution activity, no matter how conventional or obvious in itself, can transform an unpatentable principle into a patentable

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[14] In its recent opinion in *In re Walter*, 205 U.S.P.Q. 397, 406, 410 (C.C.P.A. 1980), the CCPA reiterated its interpretation of *Flook*, but nonetheless affirmed the Board's rejection of method claims to a programmed algorithm for cross-correlating seismic signals, finding that they were essentially for a mathematical algorithm. 205 U.S.P.Q. at 408–409. In *Walter* the CCPA attempted to distinguish the instant case on the basis that respondents' contribution involved "refining and further defining" a step of the rubber molding process. But whatever "refinement" respondents brought to the process resulted from the programmed algorithm and not from any new method for curing rubber products. Indeed, we see no material difference between the *Walter* method claims and the claims in the instant case, even under the CCPA's approach. Here, as in *Walter*, the specification describes certain apparatus in a general way, but the programmed algorithm is useful in "widely differing embodiments and applications" (Pet. App. 52a; compare 205 U.S.P.Q. at 408–409). Thus, just as the *Walter* claims set forth "the environment in which the improvement operates" (205 U.S.P.Q. at 409), here the "disclosures and the description * * * are purely illustrative" and were "not intended to be in any sense limiting" (Pet. App. 52a).

> process exalts form over substance. A competent draftsman could attach some form of post-solution activity to almost any mathematical formula; the Pythagorean theorem would not have been patentable, or partially patentable, because a patent application contained a final step indicating that the formula, when solved, could be usefully applied to existing surveying techniques. The concept of patentable subject matter under § 101 is not "like a nose of wax which may be turned and twisted in any direction . . . ." *White* v. *Dunbar*, 119 U.S. 47, 51.

For precisely the same reason, the fact that respondents' application recites in general terms the existing rubber-molding process does not transform his unpatentable principle into a patentable process.

CONCLUSION

For the foregoing reasons, the judgment of the Court of Customs and Patent Appeals should be reversed.

Respectfully submitted.

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JUNE 1980

APPENDIX

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APRIL 19, 1976

In the Application of

JAMES R. DIEHR, II AND THEODORE A. LUTTON

Serial No. 602,463

Filed August 6, 1975

FOR DIRECT DIGITAL CONTROL OF RUBBER MOLDING PRESSES

Group Art Unit 236

Examiner: Joseph F. Ruggiero

Commissioner of Patents and Trademarks
Washington, D.C. 20231

Dear Sir:

AMENDMENT

In response to the Official Action of January 26, 1976, please amend the application as follows:

* * * * *

REMARKS

The Examiner is thanked for having graciously held an interview with Applicants' Attorney, Robert E. Wickersham, on March 24, 1976, with Joseph D. Ekland (Manager, Manufacturing Systems, Manufacturing Engineering Services of the Assignee) and Jay Cantor (Mr. Wickersham's Washington Associate) present.

The application and the Office Action of January 26, 1976, were discussed. As the objection and rejection under 35 U.S.C. 112 were discussed, and Mr. Ekland took notes on the proper substance of an affidavit to rebut the objections noted. The enclosed Affidavit is the result, and it is believed that it shows that the application does disclose quite sufficient material to enable one skilled in the art to carry out the invention. Therefore, it is believed that the application does comply with 35 U.S.C. 112.

* * * * *

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the application of

JAMES R. DIEHR, II and THEODORE A. LUTTON

Serial No. 602,463

Filed: August 6, 1975

For: DIRECT DIGITAL CONTROL OF RUBBER MOLDING PRESSES

Commissioner of Patents and Trademarks
Washington, D.C. 20231

Dear Sir:

AFFIDAVIT

I, Joseph D. Ekland, being first duly sworn, depose and say:

* * * * *

9. THAT I am familiar with Fig. 3 A & B of the above identified application;

10. THAT from these figures and the written specifications of the above application, a reasonably skilled programmer would have no difficulty in preparing a computer program in any of the standard computer languages for use in any standard computer of suitable capacity;

11. THAT I feel the project estimate given by Mr. James R. Diehr II and Theodore A. Lutton in their Rule 132 Affidavit dated 6 March 1975 and submitted with application amendment of August 5, 1975 is a fair and accurate estimate:

12. THAT to support the aforegoing statements (9, 10, 11) I furnish the following narrative which such a programmer might first prepare, and an example of this program as translated into FORTRAN.

FLOWCHART NARRATIVE (REF: Fig. 3-A)

11) Hardware timer interrupts system and starts scan cycle.

12) Data on press status and analog temperature data read into press.

21) Test input bit switch to determine if press is closed. If yes, go to 31). If no, go to 41).

31) Add ΔT time to accumulator associated with this press.

32) Fetch thermocouple data on temperature of this mold.

33) Calculate V=Antilog N (C*Z+X) where Z is value from 32) and C and X are constants.

34) Compare V with accumulator in step 31). If yes, go to 35). If no, go to 41).

35) If closure time (accumulator) were greater, open press.

41) Calculate $e = \frac{\text{set point—measured value}}{\text{dead band}}$ and truncate at the decimal point.

42) If e has a value >1, go to 43). If not, go to 51).

43) Test e = SP-MY for sign.
If negative turn heater off.
If positive turn heater on.

51) Test A switch to determine if there is a batch data entry.
If yes, go to 52).
If no, go to 61).

52) Calculate batch Arrhenius Constant C for the equation $C = \frac{\text{Ln } V - X}{Z}$ and store with compound and batch numbers.

61) Check status word for Console Interrupt. If interrupt switch is Positive, go to 62). If negative, proceed to 71).

62) Identify incoming data by press number and store data in press record location.

71) Check present press record number with press record end pointer. If press record number equals end pointer, go to 73). If press record number does not equal end pointer, go to 12).

A general FORTRAN type program to indicate method (not including dimension statements, etc.):

```
40      Enter  N = 0
50             N = N +1
```

```
100          Call DI (IDA(N), IDI(N) )
             Call AIS (6, IAIS(N))
             IF (IDI(N)) 200, 400, 400
200          IACUMT(N) = IACUMT(N) - IDLT
             IZ = CALL TEMCON (IAIS(N))
              Z = CALL FLOAT (IZ)
              V = CALL EXP(C * Z + X)
             IV(N) = CALL FIX (V)
             IF (IACUMT (N) - IV(N)) 300, 400, 40
300          CALL DO (IDOA(N), IDO (N) )
400          IE - (ISP(N) - IMV(N)/IDB(N)
             IF (IE) 500, 600, 700
500          CALL DO (IDOC(N), IDO1)
             GO TO 600
700          CALL DO (IDOC(N), IDO2)
600          IF (IB) 800, 900, 900
800          TEMP = CALL LOG N (V)
             C = (TEMP - X)/Z
900          IF (IC) 10, 20, 20
 10          CALL DISPLAY SUBROUTINE
 20          IF(N - I LAST) 30, 30, 40
 30          CALL EXIT
```

Further affiant saith not.

/s/Joseph D. Ekland

JOSEPH D. EKLAND

Subscribed and sworn to before me this 14th day of April, 1976.

/s/SHARON MANDO
Notary Public
Wayne County, Mich.
Acting in Oakland County, Mich.
My Commission expires: Aug. 23, 1977

Supreme Court, U. S.
FILED
AUG 9 1980
MICHAEL RODAK, JR., CLERK

No. 79-1112

In the Supreme Court

OF THE

United States

OCTOBER TERM, 1980

SIDNEY A. DIAMOND, COMMISSIONER OF PATENTS AND TRADEMARKS,
Petitioner,

VS.

JAMES R. DIEHR, II, AND THEODORE A. LUTTON,
Respondents.

On Writ of Certiorari to the United States Court of Customs and Patent Appeals

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QUESTION PRESENTED FOR REVIEW

The "Question Presented" by Petitioner is not even involved in this case. It is far from what is involved, and is so inaccurate and so improper that it becomes necessary to present the following counterstatement, which is substantially what the CCPA found[1] to be the question presented:

> Does a patent process claim drawn to subject matter which is otherwise statutory under 35 U.S.C. § 101 become non-statutory merely because a computer is involved in execution of a portion of the process?

As specifically applied to the facts herein, the issue becomes:

> Does a claim to a novel physical and chemical process for molding precision rubber products, normally considered to be patentable subject matter within the terms of 35 U.S.C. § 101, become unpatentable because some of the novel steps used to determine the time when cure is complete and to trigger the opening of the mold at precisely the proper time, involve, *inter alia,* the use of a programmed computer?

Parties to the Proceeding in the Court of Customs and Patent Appeals

The caption shows all the parties. However, the patent application forming the basis of this case was assigned by the inventors to Federal-Mogul Corporation of Southfield, Michigan. The inventors, Messrs. Diehr and Lutton, are employees of Federal-Mogul Corporation.

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[1]Petitioner's Appendix (Pet. App.), p. 7a.

TABLE OF CONTENTS

	Page
Question presented for review	i
Parties to the proceeding in the Court of Customs and Patent Appeals	i
Citations to the opinions below	1
Jurisdiction	1
Statute involved	2
Statement of facts	2
The patent application at issue	2
The nature and significance of the invention	3
About cure	7
How unavoidable temperature variations affect cure	9
Prosecution in the U.S. Patent and Trademark Office	11
The Examiner's final rejection in this case	13
The Board of Appeals	14
Summary of argument	15
Argument	19
I. What is the question presented by this case?	19
II. Some subsidiary issues	21
III. The Diehr-Lutton rubber molding process would be directed to statutory subject matter under §101 if no computer were involved	22
IV. The use of a programmed computer in an otherwise statutory process does not convert the whole process to non-statutory subject matter outside § 101	23
A. Do the Patent Office mail sorters determine whether claims are patentable?	24

TABLE OF CONTENTS

		Page
	B. The claims are not directed to a computer program	26
	C. Diehr and Lutton presented process claims rather than claims to an algorithm for a computer	28
V.	The opinion of the Court of Customs and Patent Appeals thoughtfully and correctly applied prior Supreme Court decisions, including the Benson and Flook cases	29
VI.	The CCPA's standards applied to the instant case demonstrate the patentability of the claimed process on the basis of prior Supreme Court opinions	33
VII.	Is the Arrhenius Equation the "only novel feature" in the claims?	38
VIII.	The claims differ from each other and therefore merit separate consideration	43
IX.	Consideration of each claim as a whole shows them all to fall in the classic category of "process" as the term is used in 35 U.S.C. 101	46
Conclusion		48

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Cases

Page

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Diamond v. Chakrabarty, 205 US at ....., No. 79-136, June 16, 1980, 48 L.W. 4714 .....20, 22, 48

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Eibel Process Co. v. Minnesota and Ontario Paper Co., 261 U.S. 45 (1923) 18, 24

Expanded Metal Co. v. Bradford, 214 U.S. 366 (1909).... 17

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Cases

Page

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Tilghman v. Procter, 102 U.S. 707 (1880) 17, 22, 36

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Victor Talking Machine Co. v. American Graphophone Co., 189 F. 359, CC SD NY (1911), affd. 190 F. 1023, CA 2 (1911) 35

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Table of Authorities Cited

Cases

Page

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Waxham v. Smith, 294 U.S. 20 (1934) 17

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28 U.S.C. section 1256 1

35 U.S.C.:

Section 101 ..... passim

Section 102 ..... 39, 41

Section 103 ..... 11, 12, 13, 14, 39, 40, 41

Section 112 ..... 11, 12, 14, 40, 41

Miscellaneous

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No. 79-1112

In the Supreme Court

OF THE

United States

OCTOBER TERM, 1980

SIDNEY A. DIAMOND, COMMISSIONER OF PATENTS AND TRADEMARKS,
Petitioner,

VS.

JAMES R. DIEHR, II, AND THEODORE A. LUTTON,
Respondents.

On Writ of Certiorari to the United States Court of Customs and Patent Appeals

RESPONDENTS' BRIEF ON THE MERITS

CITATIONS TO THE OPINIONS BELOW

The opinion of the Court of Customs and Patent Appeals (App. A to Petition, p.1a) is reported at 602 F.2d 982 and at 203 USPQ 44. The unreported opinions of the Patent and Trademark Office Board of Appeals and of the patent examiner are reprinted in the Appendix to the Petition at Appendices C, p.20a and D, p.26a respectively.

JURISDICTION

Certiorari was granted on March 17, 1980, jurisdiction having been invoked under 28 U.S.C. 1256.

STATUTE INVOLVED

The sole statute involved is 35 U.S.C. § 101, which reads:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

STATEMENT OF FACTS

The patent application at issue

The patent application at issue was filed on August 6, 1975 by James R. Diehr, II and Theodore A. Lutton. This application, Serial No. 602,463, is a continuation of application Serial No. 472,595 that was filed on May 23, 1974, which in turn was a continuation-in-part of application Serial No. 401,127 filed on September 26, 1973.[2] At issue in this case are the eleven claims in the latest-filed application.[3]

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[2]The invention is assigned to Federal-Mogul Corporation, Detroit, Michigan.

[3]All eleven claims are printed in the Appendix to the Petition (Pet. App.) at pages 57a to 62a. Three examples are claims 1, 2, and 11:

> 1. A method of operating a rubber-molding press for precision molded compounds with the aid of a digital computer, comprising:
>
> providing said computer with a data base for said press including at least,
>
> natural logarithm conversion data (ln),
>
> the activation enegry constant (C) unique to each batch of said compound being molded, and
>
> a constant (x) dependent upon the geometry of the particular mold of the press,
>
> initiating an interval timer in said computer upon the closure of the press for monitoring the elapsed time of said closure,

The nature and significance of the invention

The invention is a process for molding raw, uncured synthetic rubber into cured precision products. The process uses a mold for precisely shaping the uncured material under heat and pressure and then curing the synthetic rubber in the mold, so that the product will retain its shape and be functionally operative after the molding is completed.

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constantly determining the temperature (Z) of the mold at a location closely adjacent to the mold cavity in the press during molding,

constantly providing the computer with the temperature (Z),

repetitively calculating in the computer, at frequent intervals during each cure, the Arrhenius equation for reaction time during the cure, which is

$$\ln v = C Z + x$$

where v is the total required cure time,

repetitively comparing in the computer at said frequent intervals during the cure each said calculation of the total required cure time calculated with the Arrhenius equation and said elapsed time, and

opening the press automatically when a said comparison indicates equivalence.

2. The method of claim 1 including measuring the activation energy constant for the compound being molded in the press with a rheometer and automatically updating said data base within the computer in the event of changes in the compound being molded in said press as measured by said rheometer.

11. A method of manufacturing precision molded articles from selected synthetic rubber compounds in an openable rubber molding press having at least one heated precision mold, comprising:

(a) heating said mold to a temperature range approximating a predetermined rubber curing temperature,

(b) installing prepared unmolded synthetic rubber of a known compound in a molding cavity of a predetermined geometry as defined by said mold,

The claimed technology is chemical and mechanical, not mathematical. Messrs. Diehr and Lutton do not attempt to patent an algorithm, an equation, any form of mathematics, or any means, computer included, of performing calculations.

Federal-Mogul Corporation, the assignee of the invention, does not manufacture computers, nor does it engage in

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(c) closing said press to mold said rubber to occupy said cavity in conformance with the contour of said mold and to cure said rubber by transfer of heat thereto from said mold,

(d) initiating an interval timer upon the closure of said press for monitoring the elapsed time of said closure,

(e) heating said mold during said closure to maintain the temperature thereof within said range approximating said rubber curing temperature,

(f) constantly determining the temperature of said mold at a location closely adjacent said cavity thereof throughout closure of said press,

(g) repetitively calculating at frequent periodic intervals throughout closure of said press the Arrhenius equation for reaction time of said rubber to determine total required cure time v as follows:

$$\ln v = cz + x$$

wherein c is an activation energy constant determined for said rubber being molded and cured in said press, z is the temperature of said mold at the time of each calculation of said Arrhenius equation, and x is a constant which is a function of said predetermined geometry of said mold,

(h) for each repetition of calculation of said Arrhenius equation herein, comparing the resultant calculated total required cure time with the monitored elapsed time measured by said interval timer,

(i) opening said press when a said comparison of calculated total required cure time and monitored elapsed time indicates equivalence, and

(j) removing from said mold the resultant precision molded and cured rubber article.

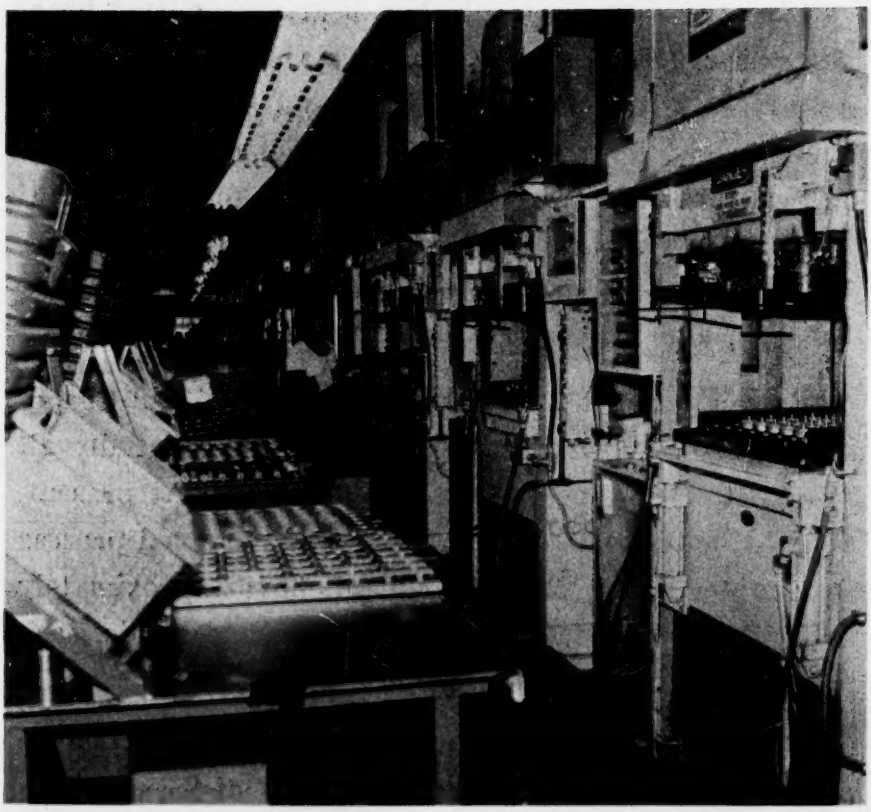
the sale of computer programs. It manufactures metal bearings (tapered roller bearings, ball bearings, journal bearings), and synthetic rubber shaft seals. Most of its shaft seals are sold to automobile, truck, and farm equipment manufacturers, to vendors of replacement parts for automobiles, trucks, and farm equipment, and to other manufacturers of bearings. The seals made by this invention prevent leakage of oil from engines, transmissions, axles, and bearings.

The invention is actually used by Federal-Mogul Corporation in its own plants to manufacture substantially all of its synthetic rubber oil seals and O-rings. At present, Federal-Mogul has four plants where the claimed process is in continuous use. These four plants have approximately two hundred presses and about ten thousand molds, each using the claimed process.

Two recent photographs are reproduced here just to help the Court visualize the general nature of the precision molding process and to save detailed description.

Each year Federal-Mogul uses the claimed process to mold about six million pounds of synthetic rubber. The total sales proceeds from products made by the claimed process since late 1973 are more than $400,000,000.00. None of this money came from the sale or license of a computer program.

Federal-Mogul estimates that the manufacturing process claimed in the claims at issue has saved it at least $25,000,000.00 over the past six years, as compared with the cost of manufacture by the prior-art processes it displaced.



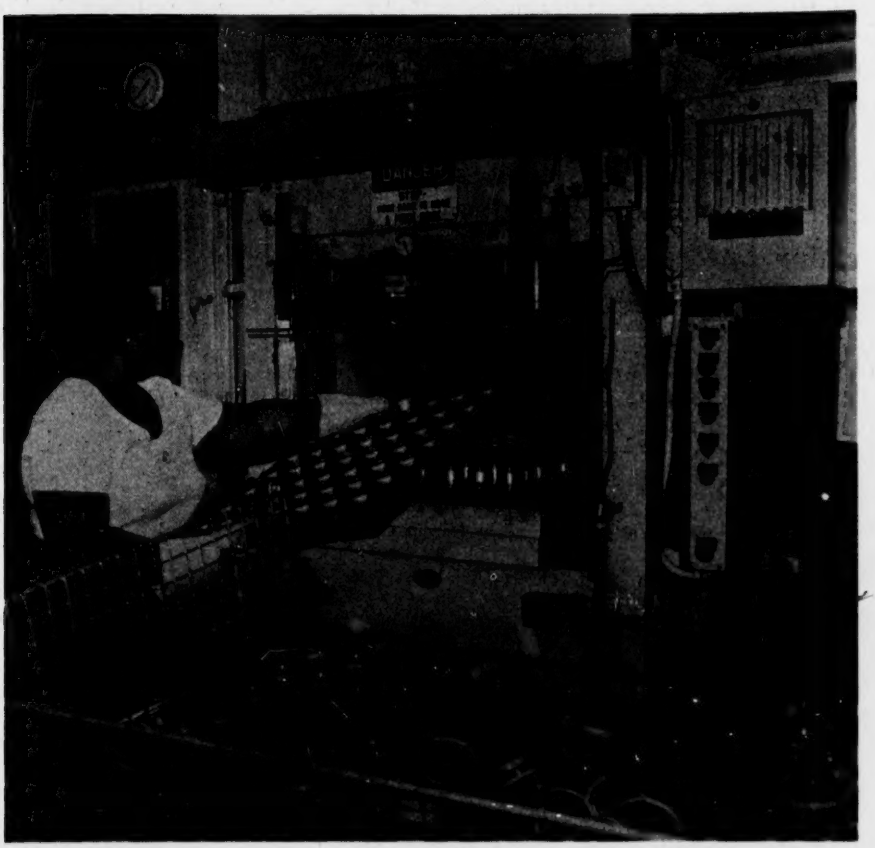
A series of presses practicing this rubber-molding invention at Federal-Mogul's plant in Summerton, South Carolina.

In addition, the claimed process has increased productivity by about *twenty percent,* by eliminating over-curing. That is, the same molds can make 20% more products of even higher quality in a given amount of time, because the present process saves time that was formerly wasted in over-curing the products.

Federal-Mogul's precision molded oil seals have been improved by this process, and the public has been benefited by less expensive and higher quality products.

About cure

The invention enables a more accurate cure of the molded elastomer or synthetic rubber. Before being molded, the elastomers used in this process are chemical compounds of a type known as polymers. They are made up of very large molecules which consist essentially of recurring long-chain structural units, the units being relatively simple chemically. These recurring long chains impart the elasticity, tensile strength, deformability, and hardness found in both natural and synthetic rubber.



A press operator in the same plant loading one of the presses that molds and cures the synthetic rubber sealing elements and bonds them to metal cases, transforming raw material into oil seals in about 2 to 2½ minutes. The foreground shows oil seals that have just been molded in that press.

Natural rubber had few uses until Charles Goodyear discovered and patented the process he called "vulcanization", now usually referred to as "cure". He discovered that an apparent accident had drastically changed—and improved—the rubber latex. His subsequent investigations led to his Patent No. 3633 and to a new industry. It was many decades, however, before chemists were able to define more clearly what had happened *chemically* to convert the tacky plastic mixture of rubber latex and sulfur to an elastic, nearly rigid product. The chemistry and production techniques are somewhat different with many synthetic rubbers, involving in many instances a phenomenon known as "cross-linking", in which chains of one chemical unit join together chains of a second chemical unit.

This chemical technology is what is involved in the claimed process. "Cure" is obtained by mixing curing agents into the uncured polymer in advance of molding, and then applying heat over a period of time. When the synthetic rubber is cured for the right length of time, at the right temperatures, it becomes a satisfactory product. When it is not cured long enough or is not hot enough during cure, the product is wholly unsatisfactory and must be rejected. Where the product is overcured there is deterioration in the quality of the product and the press is needlessly tied up, so that production is reduced.

Before the present invention, the industry could not uniformly obtain accurate cure. Sometimes the product came out of the mold so undercured that it had to be discarded. To avoid this disaster, the general practice was to deliberately attempt overcure, at the expense of production and some product quality.

How unavoidable temperature variations affect cure

In all processes involving cure of synthetic rubber, the cure time must be determined. The time needed to obtain a good cure depends in part on the temperature inside the press,[4] which is roughly regulated by a thermostat. Typical cure times at Federal-Mogul are about 2 to 2½ minutes. It is possible, using well-known time, temperature, and cure relationships, to calculate by means of an old well-known equation[5] when to open the press and remove the cured product. Nonetheless, uncontrolled variables present in the actual process make it difficult or impossible to postulate a single temperature from which such computations would produce a satisfactory result.

While the press is open for loading, it cools. The longer it is open, the cooler it becomes and the longer it takes to re-heat the press to the desired temperature range. Thus, the time necessary to raise the mold temperature to curing temperature is an important and unpredictable variable.[6]

Another cause of cure inaccuracy is the way thermostats work. Thermostats do not maintain a precise actual temperature; they turn on the heater when the temperature falls below a certain temperature range and turn off the heater

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[4]The geometric configuration of the press and the viscosity of the rubber when it enters the press are also important factors in computing the cure time. Pet. App. E, pp. 46a-49a.

[5]The equation is known as the Arrhenius equation, after its discoverer Svante Arrhenius (1859-1927) who received the Nobel prize for chemistry in 1903.

[6]Pet. App. E, p. 39a.

when the temperature rises above that range.[7] Control by thermostats alone is insufficient to insure that the desired or *nominal* temperature is actually maintained as the *average* temperature, and the average temperature is rarely, if ever, the nominal temperature. Hence, the prior-art calculations of proper cure time were based on guesswork and could not be accurate. The conventional practice of erring on the side of caution usually led to overcuring the rubber, while keeping the mold open longer than usual during unloading and reloading often resulted in undercuring.[8]

Although Diehr and Lutton use thermostats for rough control of the temperature range, they also provide for measuring the *actual* temperature in the closed press through use of a thermocouple and for doing so *continuously*. Every few seconds the *actual temperature measurements* are automatically fed into a digital computer to enable rapid calculation.[9] For each new measurement the computer recalculates the needed cure time, using the well-known Arrhenius equation. When the recalculated cure time equals the actual elapsed time since the press was closed, the computer signals a device which then opens the press.[10]

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[7]Mold thermostats are usually actuated by a change of plus or minus 2% for a desired or *nominal* temperature. Thus, if the desired or nominal cure temperature is 300° the range would be 294° to 306°—a twelve degree range. This means that the mold, when closed, would be heated until it exceeded 306°; then it would not be heated again until the temperature fell below 294°.

[8]Pet. App. E, p. 40a.

[9]*Ibid.*, pp. 41a, 45a.

[10]*Ibid.*, pp. 42a, 45a, 46a.

Prosecution in the U.S. Patent and Trademark Office

The invention's history in the Patent and Trademark Office was irrelevant to the hearing before the Board of Appeals and to the hearing before the Court of Customs and Patent Appeals. However, Commissioner Diamond's brief before this Court has raised certain points which, though respondents consider them irrelevant, are asserted by Diamond's brief to be important. These relate to the relevance of the Gould patent, the Davis patent, and other prior art. In that connection the progress of the applications through the Patent and Trademark Office needs to be considered, and the following tabulation summarizes the stages of prosecution:

CHRONOLOGICAL TABLE
OF PATENT OFFICE PROCEEDINGS

Applicants	Examiner
1. Original application SN 401,127 filed September 26, 1973. Did not include Figs. 3A and 3B or the Arrhenius equation. Two claims presented. (See Appendix A, p. A-1).	2. Rejection January 24, 1974 a) § 112 (insufficient disclosure because no computer program disclosed) b) § 112 (confusing wording in claim 2) c) § 103 (obvious in view of prior art pertaining to Neugroschl) d) § 101 (non-statutory subject matter) (See Appendix B, p. A-3).
3. Continuation-in-part application SN 472,595, filed May 23, 1974. Figs. 3A and 3B and Arrhenius equation added. Five claims presented. (See Appendix C, p. A-5).	

4. Rejection December 17, 1974
   a) § 112—(insufficient disclosure)
   b) § 103—(citing Neugroschl in view of Gould et al.)
   c) § 103 (citing Smith)
   d) § 101—as before
   (See Appendix A, p. A-7).

5. Amended application March 13, 1975. Claims revised; added a sixth claim. All points argued; three affidavits provided, one under Patent Rule 131 to remove Smith as reference. (See Appendix E, p. A-10).

6. Final rejection May 13, 1975
   a) § 112 as before
   b) § 101 as before
   Rejection under §103 not repeated.

7. Present Continuation Application SN 602,463 filed August 6, 1975. No new matter, but presented 10 claims. Previous affidavits resubmitted with preliminary amendment arguing all points. (See Appendix F, p. A-16).

8. Rejection January 26, 1976 applying only § 112 and § 101 both as before. Stated "Patents A-E are cited of interest but are not applied against the claims." (See Pet. App. 26a-30a, repeated 31a-34a).

9. Interview with examiner March 24, 1976.

10. Amended application April 21, 1976. Added claim 11 and submitted 2nd affidavit of Ekland. (See Appendix G, p. A-17).

11. Final rejection July 8, 1976. Applied *only* § 101. (See Pet. App. 35a-37a).

12. Brief for PTO Board of Appeals, October 21, 1976 Argued § 101 rejection only. Noted that § 103 rejections were withdrawn. (See Appendix H, p. A-18).

13. Examiner's Answer February 23, 1977 Argued only § 101 rejection. Stated: *"No references have been relied on."* (See Appendix I, p. A-19).

14. Board of Appeals Decision August 18, 1978.

15. Appeal to CCPA November 27, 1978. Only on § 101 rejection.

16. Decision of CCPA August 9, 1979.

As the chronological table shows, the examiner withdrew all rejections based on prior art during the pendency of the second application, and he *never* repeated them during the pendency of the present application.[11]

The Examiner's Final Rejection in this Case

The patent examiner finally rejected the invention on the *sole* ground that it was drawn to nonstatutory subject

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[11]Applicants' arguments before the Examiner were successful in overcoming a rejection under § 103 on the combination of references Neugroschl and Gould et al. These are their arguments:

Gould et al. were concerned with certain tire curing situations allowing the insertion of a thermocouple probe directly into a tire undergoing cure in the press. Apparently Gould et al. felt that in the cure of articles of the size and relative crudeness of tires, the deformities of the tires caused by insertion of the thermocouple was offset by a claimed increased accuracy of temperature readings. The Gould method is entirely unworkable in curing "precision molded compounds" which are the workpieces of the method of the present invention, and applicants' claims exclude Gould's use of a probe that projects into the article, calling for "constantly determining the temperature (Z) of the mold at a location closely adjacent to mold cavity."

Gould is further distinguished in that Gould relied on an analog computer to calculate cure in terms of "cure units," each cure unit being defined as the cure obtained at a given temperature for *one minute* (Gould, claim 1). The present invention provides a much more accurate calculation of cure time by *repeatedly recalculating* the Arrhenius equation "at frequent intervals during each cure" (See applicants' claim 1). As is well known in the art, modern computers are able to calculate a program cycle of the types specified by Fig. 3 of the present invention in an amount of time typically in the order of one second (See applicants' claim 6). Thus, the present invention further patentably distinguishes over Gould. See appendix herein, pp. A-11, A-12.

matter under 35 U.S.C. 101.[12] In his earlier rejections he had contended that those steps in the Diehr and Lutton claims that are "carried out by the computer under control of a stored program" are nonstatutory under *Gottschalk v. Benson,* 409 U.S. 63 (1972).[13] He contended throughout the prosecution that the "physical" steps in the process were conventional.[14] Diehr and Lutton did not agree with that nor with his overall conclusion and appealed.

The Board of Appeals

The Patent and Trademark Office Board of Appeals (the Board) unanimously affirmed the rejection.

The Board correctly found that the specification, while not containing a computer program as such, did contain a "sufficient" description from which a "person of ordinary skill in the art" could write a computer program.[15]

However, the Board then mistakenly stated that the step of "constantly determining the temperature (Z) of the mold . . ." appeared "to be within the prior art as described in 'Background of the Invention', specification pages 1-3."[16] Actually, these pages[17] refer to the use of *thermostats* as

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[12]Pet. App. D, pp. 36a, 37a. As the table, *supra,* shows, the patent examiner had rejected the parent case under Sections 103 and 112 as well as Section 101. In the present case he first rejected the case under Section 112 as well as Section 101. Due to prosecution, the examiner was apparently satisfied as to all issues except as to Section 101.

[13]Pet. App. D, pp. 28a, 33a, 34a.

[14]*Ibid.*, pp. 36a, 37a.

[15]Pet. App. C, pp. 21a, 22a.

[16]*Ibid.*, p. 22a.

[17]Pet. App. E, pp. 39a-41a.

being old, and do not refer to the steps of constantly *determining* (as by a thermocouple) the *actual* temperature. The Board missed this vital difference.

The Board, confusing the use of a thermostat with the *continuous measurement of actual* temperatures, and considering the claims step by step rather than as a whole, then stated:

> It is our view that the only difference between the conventional methods of operating a molding press and that claimed in applicants' application rests in those steps of the claims which relate to the calculation incident to the solution of the mathematical problem or formula used to control the mold heater and the automatic opening of the press.[18]

The Board held that this calculation was respondents' "contribution" and was "a computer program of the character" that is nonstatutory under *Gottschalk v. Benson, supra,* 409 U.S. 63, and *Parker v. Flook,* 437 U.S. 584 (1978).[19]

The Court of Customs and Patent Appeals (CCPA) reversed in a unanimous decision.

SUMMARY OF ARGUMENT

The term "computer program"—a term ill-defined in the Commissioner's brief—should not be a shibboleth to decide the outcome of this case or of others like it. Instead, the case requires careful study of the law regarding processes which include some steps that are physical and chemical

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[18]Pet. App. C, p. 24a.

[19]*Idem.*

and some steps that involve calculation. Hence, the "Question Presented" by this case should be accurately defined. The Commissioner's stated Question is not posed by the case and answering it would not decide the case. The Question as phrased by Respondents is an accurate one and answering it decides this case.

A rubber-molding process is subject matter that is well known to be statutory under 35 U.S.C. § 101. Involving a computer and its calculations in the claimed process does not remove the process from its statutory category.

Unlike the claims in *Parker v. Flook*, the present claims are true process claims; they are directed to the molding and curing of synthetic rubber. They do not recite and are not directed to a computer program. They are not intended to claim and do not claim a computer program or a calculation *per se* or a mathematical formula *per se*. The invention employs a programmed computer to refine certain steps where rapid repetitive calculation is combined with constant temperature monitoring in order to replace guesswork cure times with accurate cure times. The claimed process converts an uncured synthetic rubber mass, useless in itself, into a highly useful precision product such as a lip-type shaft seal or oil seal. The claims meet the standards required of process claims, claim no more than the inventive process, and do not attempt to monopolize any mathematical algorithm.

The Court of Customs and Patent Appeals carefully studied and correctly applied *Gottschalk v. Benson* and *Parker v. Flook;* its opinion is sound and worthy of complete affirmance. The CCPA swept aside irrelevant issues

such as whether a "computer program" is patentable and whether there is "novelty", and it applied a sound test for determining the issue of statutory classes of invention under 35 U.S.C. § 101.

The CCPA cannot be charged with systematically and consistently reversing the Board. In some § 101 cases the CCPA has affirmed the Board, while in others it has reversed the Board. These affirmances and reversals are not whimsical or arbitrary; they are based on sound application of sound principles set forth by this Court in *Flook, Benson,* and a long line of cases going back to *Cochrane v. Deener*[20] and *Le Roy v. Tatham.*[21]

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[20] 94 U.S. 780 (1876). The CCPA utilized the principle that "processes" are statutory subject matter. The Supreme Court, in *Cochrane v. Deener* considered a process of manufacturing flour and set forth a definition of the "process" class of patentable subject matter. *Ibid.*, at p. 788. "That a patent can be granted for a process; there can be no doubt," states the Court in *Tilghman v. Proctor,* 102 U.S. 707, 722 (1880). Significantly, the Court there refers to the patentability of the Goodyear process for curing rubber.

The Court further supported the patentability of processes in *O'Reilly v. Morse,* 15 How. 62, (1853), (all claims but one upheld for a process for using electromagnetism to produce telegraphic symbols), *Expanded Metal Co. v. Bradford,* 214 U.S. 366 (1909), (claims involving mechanical manipulation of metal sheets upheld, see p. 385 regarding "processes"), and *Waxham v. Smith,* 294 U.S. 20 (1934), (claims upheld on a process for hatching eggs).

[21] 14 How. 156 (1852). The CCPA also based its decisions on the idea that while a scientific principle is not patentable, the application of such a principle is. In *LeRoy v. Tatham* claims were upheld for a combination of parts of machinery which made pipes and tubes, but the Court said "fundamental truths" were not patentable. *Ibid.*, at p. 175. In *Rubber-Tip Pencil Co. v. Howard,* 20 Wall. 498, at 507 (1874), the Court noted that a new device which makes

The present case is a drastic contrast to *Parker v. Flook*. In *Flook* it was conceded that the *only* novelty lay in a new equation. In the present case the equation is very old and is not in the least novel, but the claimed process involves novel *steps*, including continuously determining the actual temperature at the mold cavity without damaging the precision molded parts. The high frequency of recalculation is also a novel step. More important, the subject matter of each claim *as a whole is novel.*

Novelty, however, is irrelevant to the § 101 issue of whether the invention lies in a statutorily patentable class. Even if novelty *were* at issue, the examiner and the Board have, in effect, admitted that novelty and unobviousness are both present.[22] Moreover, if novelty is now to be made an issue at *this late stage*, respondents should be given an opportunity to present additional evidence.

Finally, since the eleven claims embody the real issues, they should be studied both as a group and individually. When so studied, it will be seen that they claim process of the type declared by § 101 to be patentable.

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an idea practically useful is patentable. An improvement in a paper making machine which utilized the law of gravity was held patentable in *Eibel Process Co. v. Minnesota and Ontario Paper Co.*, 261 U.S. 45 (1923). In *Funk Brothers Seed Co. v. Kalo Co.*, 333 U.S. 127 at p. 130, (1948), the Court held that patentable invention comes "from the application of the law of nature to a new and useful end." In *Mackay Radio Co. v. Radio Corp. of America*, 306 U.S. 86 at 94 (1939) this idea was also clearly stated.

[22]The Board can only decide issues presented to it or raised by it specifically under the procedure set up by 37 C.F.R. 1.196(b), and no such new issues were raised.

ARGUMENT

I. WHAT IS THE QUESTION PRESENTED BY THIS CASE?

Before determining the answer to the question presented by this case, the Court should be presented with an accurate statement of that question.

The Commissioner's brief says that the question is:

> "Whether a computer program that regulates the curing time of rubber products in a mold is patentable subject matter under 35 U.S.C. 101".

That is *not* the question presented to this Court. It cannot be. Applicants do not seek to patent *any* computer program. If the Court were to decide that such a computer program is patentable, it would not decide this case. Nor would this case be decided if the Court were to decide that such a computer program is *not* patentable. The question phrased by the Commissioner's brief is irrelevant, and argument on it is purposeless.

The case *does* present eleven claims in a patent application. The PTO Board of Appeals decided that they were directed to non-statutory subject matter, not included in 35 U.S.C. 101. The CCPA reversed and held that the subject matter of all eleven claims defined a *process* within the terms of 35 U.S.C. 101.

The Board of Appeals erroneously said (Pet. App. pp. 24a, 25a), "We think that appellants' contribution, regardless of claim format, is a computer program of the character which the USSC has indicated, in both Flook and Benson, is outside the bounds of 35 U.S.C. 101." The CCPA found that in both *Flook* and *Benson*, the Court held claims

unpatentable because they were for an improved method of calculation or a mathematical formula, not because a computer program was involved. The CCPA also held that the present claims are *not* directed to a mathematical formula or a method of calculation but to a process or method for molding rubber articles.

The Board of Appeals also incorrectly held that each element of the claims was "conventional" except for the calculation steps—and did not seem to notice that applicants had forthrightly stated that the Arrhenius equation was *very* old! Before the CCPA, Diehr and Lutton vigorously contended for the novelty of each claim *as a whole* and for the novelty of measuring the temperature in the mold. However, the CCPA held (correctly) that novelty had nothing to do with patentable subject matter under § 101 and that arguments on that point were irrelevant (Pet. App. p. 13a).

The Supreme Court, in the *Benson* and *Flook* cases, has referred the patentability of computer programs *per se* to Congress, and respondents have no reason for contesting that point.

However, the Supreme Court has also held that mechanical, physical, and chemical processes are patentable subject matter—both before § 101 was enacted and since. As this Court has noted in *Diamond v. Chakrabarty,* 205 US at ....., No. 79-136, June 16, 1980, 48 L.W. 4714 "*Flook* did not announce a new principle that inventions in areas not contemplated by Congress when the patent laws were enacted are unpatentable *per se.*" (Last sentence in IV B of the opinion).

Therefore, respondents submit that the base question presented in this case is:

> Does a patent process claim drawn to subject matter which is otherwise statutory under 35 U.S.C. 101 become non-statutory merely because a computer is involved in execution of a portion of the process?

Phrased more specifically, the question becomes:

> Does a claim to a novel physical and chemical process for molding precision synthetic rubber products—a process normally considered to be patentable subject matter within the terms of 35 U.S.C. § 101—become unpatentable because some of the novel steps used to determine the time when cure is complete and to trigger the opening of the mold at precisely the proper time, involve, *inter alia*, the use of a programmed computer?

II. SOME SUBSIDIARY ISSUES

It will help in answering the main question to consider some subsidiary issues that have readily apparent answers:

1. Is a physical and chemical process for molding precision synthetic rubber products and *not* using a computer a "process" patentable under § 101?

The answer is clearly yes. The Goodyear Patent is a classical example.

2. Are all inventions that *involve* a computer or a computer program unpatentable *per se*?

We believe the answer is no, according to both *Benson* and *Flook*.

3. Are all inventions that *involve* a calculation unpatentable *per se*?

Again, the answer appears to be no, according to *Mackay Radio v. Radio Corp. of America,* 306 U.S. 86 (1939).

III. THE DIEHR-LUTTON RUBBER MOLDING PROCESS WOULD BE DIRECTED TO STATUTORY SUBJECT MATTER UNDER § 101 IF NO COMPUTER WERE INVOLVED.

A process for molding and curing synthetic rubber oil seals and other precision products would normally be considered a "process" of the type stated in 35 U.S.C. 101 as one of the statutory classes of invention. It has been so considered for more than 100 years.[23]

"That a patent can be granted for a process, there can be no doubt," stated the Court in *Tilghman v. Procter,* 102 U.S. 707, 722 (1880). Significantly, the Court referred to the patentability of a process for vulcanizing rubber:

> "Goodyear's patent was for a process, namely, the process of vulcanizing india-rubber by subjecting it to a high degree of heat when mixed with sulphur and mineral salt. The apparatus for performing the process was not patented, and was not material. The patent pointed out how the process could be effected, and that was deemed sufficient."

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[23]In *Diamond v. Chakrabarty,* 205 U.S. ....., 48 L.W. 4714, No. 79-136, June 16, 1980, the Court clearly and sufficiently discusses the historical purposes of the patent law and of § 101; so it is not necessary to reiterate this history in the present case. The Court appropriately notes in *Chakrabarty* that it is the function of Congress to define patentable subject matter, which it did in § 101, but it is the function of the judiciary to construe the boundaries of this definition. *Ibid.*, p. ..... The statutory nature of processes which involve computers is a matter thus best dealt with by the courts. No legislation is needed to determine whether processes like that involved here are appropriate subject matter, for § 101 provides sufficient guidelines.

Processes for molding and curing natural and synthetic rubber have been patented in profusion. Currently, such processes are classified in Class 264 by the PTO and many such process applications are examined and issued as patents every year. The examination is usually done by a *chemical* examining group.

IV. THE USE OF A PROGRAMMED COMPUTER IN AN OTHERWISE STATUTORY PROCESS DOES NOT CONVERT THE WHOLE PROCESS TO NON-STATUTORY SUBJECT MATTER OUTSIDE § 101.

As the CCPA soundly stated in its opinion below (Pet. App. pp. 7a-8a):

> A claim drawn to a process or method does not depend for its validity under 35 U.S.C. 101 on whether a computer is involved. If the claim is drawn to subject matter, *which is otherwise statutory,* it does not become nonstatutory merely because a computer is involved in its execution.

In its more recent decision in *In re Walter*, 618 F.2d 758, 205 USPQ 397, (1980), the CCPA held that the claims there had "no substance apart from the calculations involved. The calculations are the beginning and end of the claims. Thus, this case [In re Walter] falls squarely within the holding in *Flook,* and the claims must be held to be nonstatutory." 618 F.2d 758, 769, 205 USPQ 397 at 409.

In that same decision, the CCPA distinguished *Diehr* from *Walter*[24]:

> This case is also distinguishable from our recent In re Diehr, 602 F.2d 982, 203 USPQ 44 (CCPA

[24]618 F.2d 758, 770, 205 USPQ 397, 410 (CCPA 1980).

> 1979), cert. granted *sub nom.* Diamond v. Diehr, 48 U.S.L.W. 3602 (Mar. 19, 1980). There appellants invented a process for molding synthetic rubber articles in which one physical step of the process, maintaining the blank in the mold for the proper period of time, was improved by refining and further defining the step with the aid of mathematics. The improvement yielded a higher quality product over prior processes which did not keep the blank in the mold for sufficient time or kept it there too long. The equation used in the process remained available for others to use in the rubber-making art as well as other arts; in fact, the equation used had long been in use in rubber-molding processes. The inventors used it to refine a physical step in the process in a manner analogous to the manner in which mathematics and physical laws were employed in the inventions in Mackay Radio[25] and Eibel Process Co.,[26] supra.

In its decision below in *this* [the present] case, the CCPA further said:

> ". . . we do not find either the presence or absence of computer-related recitations in a claim to be of any significance."[27]

Respondents urge that the CCPA is correct.

A. Do the Patent Office Mail Sorters Determine Whether Claims are Patentable?

The practice of arbitrary assignments of patent applications to the various examining groups by the PTO mail

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[25] *Mackay Radio Co. v. Radio Corp. of America*, 306 U.S. 86 (1939).

[26] *Eibel Process Co. v. Minnesota Paper Co.*, 261 U.S. 45 (1923).

[27] Pet. App., p. 14a.

sorters resulted in anomalous treatment of the Diehr and Lutton application.

After the mail has been opened and date-stamped in the Patent and Trademark Office, it is sorted. New patent applications are sent to a special group of intelligent sorters constituting what is termed the Application Division. There, someone reads the claims enough to determine where to send the application for examination. The application is then sent to an "examining group" specializing in the subject matter of that application.[28]

The applications that resulted in the Gould and Davis U.S. Patent No. 3,718,721[29] and in the Davis and Gould U.S. Patent No. 3,649,729[30] both called for methods for curing rubber tires, and both were sent to a chemical examining group. Both inventions used the Arrhenius equation and a programmed computer to determine the length of cure. The chemical examining group was not troubled by the presence of either the computer or the calculations, and the patents were issued.[31]

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[28] See *Manual of Patent Examining Procedure*, Original 4th ed., dated June 1979, U.S. Dept. of Commerce, Patent and Trademark Office, §§ 501, 503, 504, pp. 55, 57, 58.

[29] Issued Feb. 27, 1973, reprinted in part at Pet. App. F, pp. 63a-72a.

[30] Issued March 14, 1972, reprinted in part at Pet. App. G, pp. 73a-80a.

[31] Since Davis and Gould read temperatures by means of a probe actually placed *inside* the tire, their system cannot be used in molding *precision* products. Moreover, they calculated "cure units" only *once per minute*; so their cure data and units were too inaccurate for use in precision products like those involved in this case.

The present application was sent by the Application Division to a *computer* group—an electrical examining group—which does not examine the art of molding and curing synthetic rubber. Apparently, once a case arrives there, it is a computer case. It joins the stack of "computer program cases" referred to in the Petition for Writ of Certiorari in *Diamond v. Bradley*,[32] and therefore is rejected.

In effect, then, a mail sorter in the Application Division decides the patentability of an invention by deciding where to send the patent application. Although the statute should be applied uniformly throughout the Patent and Trademark Office, it is not. By arbitrarily assigning the Diehr and Lutton application to a computer examining group rather than a rubber molding examining group, the mail sorter (in a way) made the initial § 101 determination in this case. The CCPA has corrected this anomaly, and its analysis and application of § 101 deserves affirmance.

B. The Claims are not Directed to a Computer Program.

Diehr and Lutton did not disclose a computer program in the application. The patent application's flow sheets, Figs. 3A and 3B do, however, provide all that a programmer needs to construct a program except for the data base —the rubber cure data, the mold shape and size data, and so on.

The claimed process might possibly be practiced without a digital computer, but the speed and convenience of the computer certainly render the use of a programmed

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[32] No. 79-855. See Bradley Pet., p. 13.

digital computer preferable. Enough is disclosed to make that possible.

However, Diehr and Lutton claimed neither the flow sheets nor a computer program derived from the flow sheets. The claims are for a synthetic rubber molding and curing process *utilizing* a digital computer in claims 1-10.

The language of the claims confirms this assertion. Notice a step such as "constantly determining the temperature (Z) of the mold at a location closely adjacent to the mold cavity in the press during molding" (Claims 1 and 7; similar wording applies to all claims).

Claim 1 also states "initiating an interval timer in said computer upon the closure of the press for monitoring the elapsed time of said closure." The other claims have similar requirements.

Claim 7 specifically states "installing prepared unmolded synthetic rubber of one said compound in a molding press cavity" and "removing the resultant precision molded article from the press".

Claim 11 contains many non-computer steps including heating the mold.

The key element in each claim is always the mold with its heater. Other equipment is required, including thermostats, an accurate and sensitive thermometer or thermocouple, a timer, and a programmed digital computer. However, computers do not mold rubber. Computers do not measure temperature. Computers, as such, do not measure time.

A computer program will never mold rubber. Federal-Mogul wants precision rubber products, not data for its own sake, not numbers, not a computer program for its own sake. Federal-Mogul's patent attorneys have tried to express that in the eleven claims at issue.

C. Diehr and Lutton Presented Process Claims Rather than Claims to an Algorithm for a Computer.

The Commissioner's brief in *Diamond v. Bradley*[33] says at pages 13 and 14:

> There is an important difference between patenting a novel process and patenting an algorithm for a computer program. With the novel process the inventor seeks to preclude others from actually carrying out the procedures of his invention. *Cochrane v. Deener* 94 U.S. 780, 788 (1876). Nothing in the patent law, however, would prevent others from writing down and passing on the description of his process as long as the process itself was not practiced. But with the algorithm for a computer program the inventor seeks to prevent others from even communicating his new idea by translating his algorithm into a program and loading the program into a computer. In other words, he seeks to patent the idea itself, or at least a form of expressing it.

By that standard there can be no doubt that Diehr and Lutton seek to patent a process, not an algorithm for a computer nor the idea itself.

All that Federal-Mogul wants is a patent which will keep unlicensed persons from making precision-molded synthetic rubber products according to the process. So far as Federal-

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[33] No. 79-855. To be argued in tandem with the instant case.

Mogul is concerned, it only wants what it claims. The claims, if allowed, will not prevent the flow sheets of Figs. 3A and 3B—and also Figs. 1 and 2—from being printed in the newspapers or reprinted by its competitors. The claims leave competitors free to program their computers in accordance with the flow sheets and with the description in the specification—so long as they do not *manufacture rubber products* by the claimed process, for that is all that the claims in issue cover.

When a patent issues, it is printed, and anyone can get a copy for fifty cents and reproduce any or all pages with impunity. They can program their computers by it, and Federal-Mogul would have no right to sue—unless they practice the rubber molding process. Federal-Mogul applied for a patent in order to be in a position where it might receive reasonable royalties from *licensed* users. Such a license is not based on how many copies of the program are printed out, but rather on the practice of the actual process.

V. THE OPINION OF THE COURT OF CUSTOMS AND PATENT APPEALS THOUGHTFULLY AND CORRECTLY APPLIED PRIOR SUPREME COURT DECISIONS, INCLUDING THE BENSON AND FLOOK CASES.

The CCPA has conscientiously followed this Court's decisions in patent cases involving computer-related claims and technology. Respondents have endeavored to survey cases involving computer-related claims and technology which have come before the CCPA and have come up with the following results as of July 1, 1980. Thirty-eight cases

concerning computers were analyzed, which represented all computer CCPA patent cases other than those that went to the Supreme Court for decision. Of these, the scope of patentable subject matter under 35 U.S.C. § 101 was considered in sixteen reported cases, not including the present case or the *Bradley* case, infra. The applicable Supreme Court decisions were considered in every single one of those opinions.[34] Eight decisions affirmed the Board,[35] while eight reversed.[36] A review of those opinions reveals the great pains which the judges of the court below have used

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[34]Some of those opinions were issued before *Flook* was decided, and therefore it was not cited therein.

[35]Cases affirming Board rejections and applying *Flook* and/or *Benson*:

In re Walter, 618 F.2d 758, 205 USPQ 397 (CCPA 1980);
In re Maucorps, 609 F.2d 481, 203 USPQ 812 (CCPA 1979);
In re Gelnovatch, 595 F.2d 32, 201 USPQ 136 (CCPA 1979);
In re Sarkar, 588 F.2d 1330, 200 USPQ 132 (CCPA 1978);
In re Richman, 563 F.2d 1026, 195 USPQ 340 (CCPA 1977);
In re de Castelet, 562 F.2d 1236, 195 USPQ 439 (CCPA 1977);
In re Waldbaum, 559 F.2d 611, 194 USPQ 465 (CCPA 1977);
In re Christensen, 478 F.2d 1392, 178 USPQ 35 (CCPA 1973);

[36]Cases reversing Board rejections and applying *Flook* and/or *Benson*:

In re Sherwood, 613 F.2d 809, 204 USPQ 537 (CCPA 1980), Cert. granted *sub nom Diamond v. Sherwood*, 79-1941;
In re Phillips, 608 F.2d 879, 203 USPQ 971 (CCPA 1979);
In re Johnson, 589 F.2d 1070, 200 USPQ 199 (CCPA 1978);
In re Toma, 575 F.2d 872, 197 USPQ 852 (CCPA 1978);
In re Freeman, 573 F.2d 1237, 197 USPQ 464 (CCPA 1978);
In re Deutsch, 553 F.2d 689, 193 USPQ 645 (CCPA 1977);
In re Chatfield, 545 F.2d 152, 191 USPQ 730 (CCPA 1976), Cert. denied, 434 U.S. 875 (1978);
In re Noll, 545 F.2d 141, 191 USPQ 721 (CCPA 1976), Cert. denied, 434 U.S. 875 (1978).

in analyzing and applying the appropriate cases and principles. The CCPA has steadfastly defended the Supreme Court decisions from seriously flawed misinterpretations advocated by the Board and Petitioner. As the CCPA held in *In re Johnson*, 589 F.2d 1070, 1081 (CCPA 1978) "There is no reason for the Solicitor or the PTO to shortcut the analytical framework set forth in Benson, Flook, and decisions of this court by relying on unfounded generalities."

The CCPA is rewarded by the PTO and the Solicitor General with most unkind criticism and misrepresentations. Thus, the Commissioner's brief in this case says on page 5:

> It [CCPA] held that this Court's analysis detailed in *Flook* was merely "a convenient vehicle" for finding the "method[] of calculation" there to be non-statutory, and did not establish "a general test in determining compliance with § 101" (id. at 13a-14a n.6).

What the CCPA actually said was:

> Although in *Flook* the Supreme Court assumed the equation of the claim to be old in the art even though it was not, the holding of that case does not depend on that mode of analysis. Since Flook's claims were held to be directed to methods of calculation, they were nonstatutory *regardless* of whether the equation was new or old. While the Supreme Court in that case may have found that analysis a convenient vehicle to highlight the fact that Flook's actual contribution to the useful arts was his new formula, we do not believe the Court meant to establish that analysis as a general test in determining compliance with § 101, especially when indiscriminately applied to claim limitations generally.[37]

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[37] Pet. App. A, pp. 13a and 14a, footnote 6.

The distortion by the Commissioner's brief is pointless, since in the present case the Arrhenius equation has always been stated by applicants to be old.

The Solicitor General states in the brief at page 10: "The court below refused, however, to apply *Flook,* summarily dismissing it on the basis that this Court never 'meant to establish that analysis as a general test' (Pet. App. A, 14a n.6)." This misapplication of what the CCPA said is reprehensible. The CCPA spent *pages* reviewing and applying *Parker v. Flook.* In the Appendix to the Petition, the discussion of the *Flook* case by the CCPA takes from page 11a to page 14a and its application extends on to page 17a. In fact, almost *all* of its section entitled "Opinion" is a discussion of *Gottschalk v. Benson* and *Parker v. Flook,* with each case discussed and applied at length.

The Commissioner's brief on page 11 says "The decision below comports with the CCPA's persistent criticism of *Flook* . . . and effectively confines *Flook* to its own facts." This is simply not true, as witness *In re Walter* and other cases cited above in footnote 35.

In the recent petition for writ of certiorari in *Diamond v. Sherwood,*[38] the PTO continues its war with the CCPA saying:

> The Court of Customs and Patent Appeals in the instant case again refused to apply the analysis of patent claims required under *Parker v. Flook* . . .(p. 6)
>
> We have explained in our brief in *Diehr* why we contend that the Court of Customs and Patent Appeals'

[38] *In re Sherwood,* 613 F.2d 809, (CCPA 1980), Cert. granted *sub nom, Diamond v. Sherwood* (79-1941).

> analysis flouts *Parker v. Flook*. That court's refusal to accept governing precedent is repeated in this case. (p. 7)

The CCPA *sometimes*—about half the time—has reversed the Board of Appeals in these computer-related cases because the Board of Appeals has gone too far. The Board has repeatedly found computer programs where none existed. The Board seeks a shibboleth that "computer programs are unpatentable" and it acts on the principles that wherever there is a computer, there is a computer program, and that any invention *utilizing* a computer program or even suggesting the use of a computer program is by that fact alone composed of claims to a computer program.

The Court is invited to look at the CCPA's record—not only at the cases where it held claims to be statutory under § 101, but also at the cases to the contrary. The CCPA does its best to follow the Supreme Court in all cases. It tries to follow intelligently—not to rubber stamp the PTO decisions in § 101 cases.

Respondent believes that the CCPA should be commended—as well as affirmed—for the way it has applied *Parker v. Flook* and *Gottschalk v. Benson* in this case.

VI. THE CCPA'S STANDARDS APPLIED TO THE INSTANT CASE DEMONSTRATE THE PATENTABILITY OF THE CLAIMED PROCESS ON THE BASIS OF PRIOR SUPREME COURT OPINIONS.

The CCPA opinion in *In re Diehr* gives clear insight into the present *modus operandi* of the CCPA in cases involving § 101. When the *Diehr* opinion is coupled with the opinion

in *In re Walter,* 618 F.2d 758, one has both sides of the coin: what the CCPA believes lies within § 101 (Diehr) and without § 101 (Walter).

After disposing of the argument that mere involvement of a computer program is decisive, in *In re Diehr* the CCPA carefully reviewed *Gottschalk v. Benson* and came to the conclusion that in *Benson:*

> [T]he claims were held to be fatally deficient under § 101, *not because a computer program was being claimed, but because a mathematical formula* or algorithm per se was being claimed. . . . [T]he claim would, in effect, dominate all practical and significant uses of the formula. Thus, the Court viewed the claim as directed to the scientific truth itself, rather than to an *application* of, or *structure* created with the aid of, the scientific truth. (Pet. App. A, p. 10a)

On this point it may be noted that Diehr and Lutton make no attempt to prevent anyone from using the Arrhenius equation—even for molding and curing synthetic rubber products. Use of that equation would become patent infringement (if the claims are issued) *only* when the user also constantly monitors the temperatures in the mold at a location closely adjacent (but not in) the mold cavity while the press is closed and *also* uses the temperature data and the equation in substantially continuous recalculation up to the time when the cure is completed and the press opened.

In its Diehr opinion, the CCPA considered *Parker v. Flook* in detail, saying "The Court determined that the claims were essentially directed to the use of a new *mathematical formula* in the conventional process of updating

alarm limits." (Page 11a.) The CCPA noted, *idem,* and quoted the following from *Flook, supra,* p. 545, footnote 18:

> "[O]ur holding today is that a claim for an improved *method of calculation,* even when tied to a specific end use, is unpatentable subject matter under § 101." (Emphasis by the CCPA).

From the *Benson* and *Flook* cases, the CCPA concluded:

> As far as we are concerned, claims may be rejected under § 101 because they attempt to embrace *only* a mathematical formula, mathematical algorithm, or method of calculation, but not merely because they define inventions having something to do with a computer. (Pet. App. p. 12a).

Respondents believe that this position is sound.

The CCPA also held that whether there was novelty in the Diehr and Lutton step of continuously measuring the temperature in the mold cavity was irrelevant to § 101. Respondents agree, while still remarking that this step is, indeed, *one* of the novel portions of the claimed process. Respondents also agree that each claim should be considered as a whole. After all, many processes that have *no* step which is novel in itself are still novel and patentable when all the steps are considered as a whole.[39]

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[39] *Victor Talking Machine Co. v. American Graphophone Co.,* 189 F. 359, at 373, CC SD NY (1911), affd. 190 F. 1023, CA 2 (1911). Deller's Walker on Patents, (Second Edition, Vol. 2, § 110), states: 1) that "a process consisting of a number of steps may be valid even though each of the steps was old." (at p. 203), and 2) "A new combination with a new mode of operation may be invention, even if all the parts thereof are old and even if the function of the combination is also old." (at p. 202).

When the CCPA turned to consider the claims, it correctly remarked that neither the presence nor absence of computer-related recitations in a claim has any significance. The CCPA then noted that the claims do indeed "directly recite a mathematical formula, namely the Arrhenius equation", so that the claims had to "be subjected to further scrutiny." (Pet. App. A, p. 14a). This follows from the CCPA's use of a two-step test to determine whether a claim involving mathematics meets the standard of § 101. This test is based on the CCPA's study of a long series of cases beginning with *Tilghman v. Proctor,* 102 U.S. 707 (1880) and concluding with *Parker v. Flook.* It has been used in a number of CCPA cases including *In re Freeman,* 573 F.2d 1237 (1978) and *In re Johnson,* 589 F.2d 1070 (1978). This test makes sense.

The first step is to determine whether the claims involve mathematical calculations. Since the claims in the present case do involve calculations, the second step must be taken.

The second step is to determine whether the claim recites no more than a mathematical formula or a method of calculation as in *Benson* and *Flook.* If that is *all* that the claim recites, it is outside the statutory classes of inventions recited in § 101.

In this case the CCPA concluded that Diehr's claims did *not* merely relate to calculation. It summed up its view of the Diehr and Lutton claims this way:

> Each of appellant's claims, *as a whole,* recites a process or method for molding rubber articles. They are an improvement over prior processes in that appellants provide for opening the mold at precisely the

> correct time rather than at a time which has been determined by approximation or guesswork. It is this feature of the process that *involves* the Arrhenius equation. The recitation of the equation is not separable from the process in which it is used; it is intimately involved in the process, but the claims are not to the equation. (Pet. App. pp. 15a-16a)

The CCPA then found the Diehr and Lutton claims to be "directly comparable to those involved in *Tilghman v. Proctor*. . . . and *Eibel Process Co. v. Minnesota Paper Co.*" *Ibid.* p. 16a. The claims involve the employment of a scientific truth to a new and useful end without attempting to control the use of the truth itself.

Finally, the CCPA found that the "claims here on appeal are fundamentally different from the claims involved in *Flook*." *Ibid.* p. 17a. In the Diehr and Lutton claims; "the calculation is intimately entwined with the rubber molding process recited." *Idem.* The CCPA said: "It would be a gross distortion to say that the claims . . . are directed essentially to calculations." *Idem.*

The Board of Appeals had sought to consider the claims "regardless of claim format."[40] The CCPA noted that and said that "one would hardly question that a rubber-molding process falls within the § 101 categories of possibly patentable subject matter, and that is what is claimed." (Pet. App. p. 17a)

Respondents ask why particularizing in claims a more precise way of timing the molding cycle should remove the

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[40] Pet. App. C, p. 24a.

claims from the "process" category of § 101. The CCPA saw no reason why and held that it did not.

As noted earlier, the CCPA has commented on *Diehr* in the case of *In re Walter.*[41] See page 23 above. The claims in *In re Walter* were drawn to a method used in seismic prospecting and surveying to unscramble jumbled signals obtained by transmitting and reflecting sound waves through the earth. The unscrambled signals enabled analysis to determine the nature of the subsurface structure of the earth. The CCPA affirmed the PTO and the Board of Appeals by rejecting the claims. It held:

> Examination of each claim demonstrates that each has no substance apart from the calculations involved. The calculations are the beginning and the end of the claims. Thus, this case falls squarely within the holding in *Flook,* and the claims must be held to be non-statutory.[42]

The CCPA's holding and analysis in the *Walter* case show its conscientious effort to apply correctly the rules of law expressed in *Gottschalk v. Benson* and *Parker v. Flook.* It distinguished the Diehr process of molding rubber oil seals from inventions like the Walter process in which the claimed physical result was "described in mathematical terms."

VII. IS THE ARRHENIUS EQUATION THE "ONLY NOVEL FEATURE" IN THE CLAIMS?

This rather absurd question is voiced because the Commissioner's brief at page 7, asserts, "This case is *Flook* revisited." The statement is not true. The present case is

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[41] *Supra,* 618 F.2d 758, 769.

[42] 618 F.2d 758, at 769, 205 USPQ 397, at 409.

distinguished from *Flook* in many ways, as has already been shown.

The claims here are directed to a process for molding and curing synthetic rubber, not to the production of a *number* followed by a "post-solution" step, as in *Flook*. However, the Commissioner attempts to distort the claims and their meaning in order to persuade the Court that novelty is relevant to § 101 and that the claims at issue are devoid of novelty.

The Arrhenius equation is one of the oldest steps in the process. It is not as old as molding itself, but it is quite old. It is *not* a *novel step* in any of the claims, and Diehr and Lutton have never pretended that it is novel.

Novelty is immaterial to the issue of statutory class of invention under § 101, and the CCPA has repeatedly so held. The CCPA has aptly noted that "the word 'new' as used in both § 100(b) and § 101 is defined in § 102 of the statute. The use of the term 'new' in § 101 adds no novelty requirement beyond what is contained in § 102, and § 102 is normally used for novelty rejections." *In re Waldbaum*, 457 F.2d 997, 173 USPQ 430, 434 (CCPA 1972), citing *In re Bergstrom*, 427 F.2d 1394, 166 USPQ 156 (CCPA 1970). The § 101 phrase "new and useful" thus merely helps to tie sections 101 and 102 together and to point out that, in addition to belonging to one of the *classes* of invention which constitute statutory subject matter, the invention must meet the requirement of § 102. Beyond that, § 103 sets forth an entirely different *condition* of non-obviousness which all inventions must also meet in order to be patent-

able; this section 103 should be applied according to the standards set forth in *Graham v. John Deere,* 383 U.S. 1 (1966).

In view of the Commissioner's arguments, however, respondents make the following statements regarding the novelty and obviousness of their invention.

The examiner, in both the original application SN 401,127 and in application SN 472,595 (in which the disclosure is *identical* to the present application SN 602,463) rejected the claims then in the case under § 103 on the basis of prior art.[43] When the applicants argued the point and furnished affidavits in opposition to this ground of rejection, the examiner did not repeat the rejection under § 103.

Under 37 C.F.R. 1.105, "the examiner's action will be complete as to all matters . . ." (Certain exceptions are not pertinent here.) 37 C.F.R. 1.113(b) says:

> In making such final rejection, the examiner shall repeat or state *all* grounds of rejection then considered applicable to the claims in the case, clearly stating the reasons therefor. (Emphasis added).

Thus, under the PTO Rules of Practice, the failure to repeat his rejection under § 103 was a withdrawal of that rejection in view of the argument made by Diehr and Lutton.

The examiner made a final rejection in the second application, S.N. 472,595, on the grounds of § 101 and § 112, but did *not* repeat or restate his prior § 103 rejection.[44] When the case was refiled as a continuation case (the present

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[43] Appendix herein, pp. A-3, A-4 and A-7 to A-9.

[44] *Ibid.*, p. A-16.

case) the examiner rejected the claims under § 101 and § 112 but made no § 103 rejection. Instead, he stated that the references on which he had made his original § 103 rejection were "cited of interest but are not applied against the claims,"[45] making clear that he was not making a § 103 rejection in the continuing application.

In his final rejection in the present case he withdrew the § 112 rejection but repeated his § 101 rejection. He did not refer to § 103.[46]

In the Examiner's Answer to the appellants' brief before the Board of Appeals, the examiner stated: *"No references have been relied on."*[47]

The most logical and likely conclusion from the file histories of these Diehr and Lutton applications is that the examiner believed that the claims meet the tests of novelty and of obviousness in §§ 102 and 103. This is the normal and only proper reason for not repeating a rejection under prior art.

The alternative conclusions would be that the examiner was extraordinarily careless or that he deliberately neglected his duty and disobeyed the Rules of Practice. Since the file history evidences great care on his part as to most aspects of the case and since he had at least *three* opportunities to correct mistakes and oversights, these alternative conclusions are completely untenable.

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[45] See Pet. App., p. 29a.

[46] *Ibid.*, p. 31a-37a.

[47] Appendix herein, p. 18a.

It is clear that the examiner settled the matters of novelty and obviousness in favor of the inventors.

However, because the Solicitor's brief has raised the issues of novelty and obviousness, a few additional points should be discussed. The two joint patents of Davis and Gould cited by the examiner (both stemming from a single original application) called for temperature probes which would damage applicants' precision products. Further, the calculation using the Arrhenius equation was performed only once per minute. This would do little good in a cure time of about 2 to 2½ minutes, as in the Federal-Mogul process as practiced. It is clear that applicants' frequent recalculations and use of the temperature probe where it could not damage the product were both novel and unobvious at the time the invention was made to people experienced in that mold art. Though novelty should be held to be immaterial since the case involved only § 101, there *is* novelty more than sufficient to overcome the Commissioner's arguments.

Moreover, if the Court believes the issues of novelty or obviousness are material, respondents at *some* stage of the proceedings should be entitled to produce additional evidence on these issues.

The Board based its conclusions regarding conventionality of the claims on three faulty premises: (1) dissecting the claims to look for novelty in particular steps, rather than viewing each claim as a whole, (2) confusing a thermocouple with a thermostat and construing the statement in the specification that thermostats had been used to hold molding temperatures within a certain range to mean con-

stantly determining the *exact* temperature, a novel feature not conceded to be old and in fact not old, and (3) failing to note that repetitive recalculation at very short intervals is also new. Constant recalculations along with continuous determinations of the actual temperatures, is the key feature here, not the equation or the fact of calculation.

The argument that the invention as claimed is old is both immaterial to the § 101 analysis at issue and incorrect in view of the facts and file history.

VIII. THE CLAIMS DIFFER FROM EACH OTHER AND THEREFORE MERIT SEPARATE CONSIDERATION.

There are important differences between the claims.[48] While these differences should not affect the § 101 issue, an understanding of the differences is helpful to an understanding of the claims at issue.

In all claims the key operation is molding, not calculating. The product is a molded and accurately cured precision product, not a number. Molding, timing, and constantly measuring the temperature are all physical steps involving no calculating. The calculating which is then used is only part of the process, yet *repetitive* calculation and comparison greatly improve the molding process.

Claim 1 is broad and states the fewest steps. It clearly defines its general nature in its preamble: "A method of operating a rubber-molding press for precision molded compounds with aid of a digital computer." It calls for a

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[48]The claims are reproduced at Pet. App., pp. 57a-62a.

step of providing the computer with its data base; this data base depends on characteristics of the compound being molded, the particular batch of that compound, and the geometry of the portion molded.

Claim 1 calls for "initiating an interval timer" when the press is closed, and calls for "constantly determining the temperature (Z) of the mold at a location closely adjacent to the mold cavity in the press during molding". It calls for "constantly providing the computer with the temperature (Z)". It then calls for "repetitively calculating in the computer, at frequent intervals during each cure, the Arrhenius equation. . . ." It also calls for "repetitively comparing in the computer at said frequent intervals . . ." the total cure time calculated from the Arrhenius equation with the elapsed time. Finally it calls for "opening the press automatically when" the "comparison indicates equivalence."

Claim 2 adds the taking of an important physical measurement to claim 1. A rheometer (not a part of a computer) is used to measure what is known as the activation energy content of the very batch of material being molded.

Claim 3 adds a different feature to claim 1—that of controlling the mold *heater* in accordance with the actually observed temperatures to keep the mold temperature within a calculated temperature range.

Claim 4 depends from claim 3 and adds that the frequent periodic interval for calculating that range is about 10 seconds.

Claim 5 is an important claim in independent form. It calls for operating a *plurality* of rubber molding presses

simultaneously. One computer can be used for many such presses—fifty or more. Each press can start and operate completely separately, but all presses are connected to a single computer that controls the cure times according to the temperatures read at each press. This very novel process is quite important. In other respects, claim 5 is much like claim 1.

Claim 6 depends from claim 5 and requires the frequency of repetitive recalculation and comparison to be once per second or faster.

Claim 7 adds specific statements of some of the necessary physical steps, previously only implied by the claims, such as "installing prepared unmolded synthetic rubber of one said compound in a molding press cavity", closing the press, and "removing the resulting precision molded article from the press". The claim was added to make it clearer that the process is one in which the synthetic rubber is changed both mechanically and chemically and emerges as a quite different product.

Claims 8-10 depend from claim 7 and are basically the same as claims 2-4 except for their dependency on claim 7 instead of claim 1.

Claim 11 does not even mention the use of a computer, and it is still more explicit as to the physical steps. It does, of course, include the steps of repetitive frequent recalculation and repetitive comparison for each recalculation. Those two steps are the only calculation and the only comparison steps out of a total of ten stated steps.

None of the claims relies on any single step for its novelty. Calculation using the Arrhenius equation is certainly old. *Frequent* recalculation (as distinguished from recalculating only once per minute, for example) is new. So is the step of constantly determining the temperature at the stated location (so as not to destroy or damage the product). But the novelty and patentability lie in *each* claim considered *as a whole,* not in particular steps. Moreover, § 101 is properly applied only to each claim as a whole, not to one or two elements thereof.

IX. CONSIDERATION OF EACH CLAIM AS A WHOLE SHOWS THEM ALL TO FALL IN THE CLASSIC CATEGORY OF "PROCESS" AS THE TERM IS USED IN 35 U.S.C. 101.

Since the claims do use the Arrhenius equation, a key point to be decided is whether each claim, considered as a whole, is drawn to a limited, specific, and practical application of the principle to produce a beneficial result or effect in one of the technological arts.

The Arrhenius equation is admittedly old and well-known in the rubber molding art. It has long been used for calculating the curing time for rubber compounds. Although each time the computer solves the Arrhenius equation, a number is obtained; unlike *Flook,* that number is not the end product of the claim. Rather, this number is then compared to the elapsed time since the mold was closed to determine if they are the same. As long as they are not the same, the process continues to monitor the temperature and to calculate the solution to the Arrhenius equation at each temperature reading. There can be no question but

that the principle of nature embodied in the Arrhenius equation is *used* within the claim such that the claim, in its entirety, is drawn to a specific, limited and practical *application* of the principle to achieve a beneficial result in one of the technological arts. The claim is not drawn to the principle.

Thus, although a principle of nature is recited in the claim, the claim as a whole is not drawn to that principle, but constitutes a use of the principle in a novel way to a practical, beneficial end. Therefore, each claim of Diehr defines patentable subject matter within the meaning of § 101.

The applicants here are not claiming "computer programs". If they were, their application would clearly be deficient since a computer program is not disclosed in the application, even though anyone of ordinary skill in the programming art can produce usable computer programs from the functional flow diagrams disclosed in their application.

Nor are they attempting to use the draftsman's skills to "word" a claim to appear as if it is drawn to something else when it in fact covers nothing but a computer program. Diehr and Lutton claim a method for molding rubber articles which *requires the use of a programmed computer* in implementing several of the method steps.

If the claimed invention is considered in its entirety, it is clear that no "principle" will be preempted by any patent which may issue with these claims. Rather, what will be patented will be a very practical, very beneficial molding

process involving the use of programmed data processors to produce desirable results in a technological art.[49]

The disclosure of these types of inventions is precisely what our patent system was intended to encourage.

CONCLUSION

Since the invention as claimed relates to a process of the type defined as patentable under 35 U.S.C. 101, whether or not a computer is utilized in practice of the invention, the decision below should be affirmed.

August 6, 1980

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[49] This viewpoint would certainly be consistent with *Diamond v. Chakrabarty, supra* footnote 23.

APPENDIX A

Claims as Submitted in Original Application S.N. 401,127 Filed September 26, 1973

1. A method of operating a rubber-molding press with the aid of a digital computer, comprising:

providing a computer with time-temperature cure data for the compound being molded in the press,

initiating an interval timer upon closure of the press,

determining the temperature of the mold cavity in the press at every instant during molding,

keeping the computer informed as to the temperature of the mold cavity,

integrating in the computer, the mold-cavity temperature with time during the cure,

comparing in the computer at frequent intervals during the cure the time-temperature integration, the elapsed time, and the time-temperature cure data, and

opening the press automatically when the comparisons indicate completion of cure.

2. A method of operating a series of rubber-molding presses in conjunction with a computer, comprising:

providing the computer with time-temperature cure data for the compounds to be molded,

informing the computer the compound being molded in each press,

measuring the cure rate of the compound for each press with a rheometer,

informing the computer about the rheometer characteristics for each compound,

constantly monitoring the temperature of each mold cavity,

informing the computer about every ten seconds in serial fashion the temperature for each said press,

integrating in the computer serially at a period of about every ten seconds the time-temperature conditions in each press,

comparing in the computer, after each said integration, the integral with the elapsed time for that press and the time-temperature data therefor, and

opening each press automatically when the comparing step indicates completion of cure for that press.

APPENDIX B

Excerpt of Patent Office Rejection of January 24, 1974 (Original Application, S.N. 401,127)

Notification of Rejection(s) and/or Objection(s) (35 U.S.C. 132)

Claims	Reasons for Rejection	References	Information Identification and Comment
1 and 2	35 U.S.C. 102		Drawn to insufficient disclosure see Part IV, par. 1
2	35 U.S.C. 112		vague and indefinite—the phrase "the computer the compound" in line 22 of claim 2 is confusing.
1 and 2	35 U.S.C. 103	A	A discloses a computer control of a molding process. Variables such as time and temperature are sensed and are fed to a programmed computer which compares such values with pre-stored values. As noted in col. 4, line 60—the time for opening the tire mold is indicated by a signal on line 70.
1 and 2	35 U.S.C. 101	A	Drawn to non-statutory subject matter. The basic concept of computer control of a rubber-mold press is disclosed by A. Any novelty in the claim, therefore must be based on the particular calculations performed by the computer according to a prescribed program. Such has been held to be non-statutory subject matter in Gottschalk v. Benson, 175 U.S.P.Q. 673.

B-D are cited of interest, but are not applied against the claims.

Part IV

1. The specification is objected to as containing insufficient disclosure under 35 U.S.C. 112 to support the appended claims. The brief description of the operation of the digital computer on page 7, line 1-11 is inadequate to comply with the requirements of the statute. Further, a digital computer by itself would be incapable of carrying out any operation until its sequence of internal interconnections has been added thereto by the preparation and loading of a program into the internal memory of the computer. The instant disclosure does not identify the program or programs needed to cause the computer to carry out the wanted functions.

Notice of References Cited

	Patent No.	Date	Patentee	Class	Sub-Class	Filing Date If Appropriate
A	3,659,974	5-1972	Neugroschl	264	40X	
B	3,579,626	5-1971	Brittain	264	315X	
C	3,649,729	3-1972	Davis et al	264	40	
D	3,718,721	2-1973	Gould et al	264	40	1-26-1970

APPENDIX C

Claims as Submitted in Continuation-in-Part Application S.N. 472,595, Filed May 23, 1974

1. A method of operating a rubber-molding press with the aid of a digital computer, comprising:

providing a computer with time-temperature cure data for the compound being molded in the press,

initiating an interval timer upon closure of the press,

determining the temperature of the mold cavity in the press at every instant during molding,

keeping the computer informed as to the temperature of the mold cavity,

calculating in the computer, the Arrhenius equation for reaction time during the cure, which is $\ln v = CZ + x$ where

$\ln v$ is the natural logarithm of the total required cure time,

C is the activation energy constant unique to each batch of compound being molded,

Z is the present temperature of the mold, and

x is a constant dependent upon the geometry of the particular mold of the press,

comparing in the computer at frequent intervals during the cure the total required cure time calculated with the Arrhenius equation and the elapsed time, and

opening the press automatically when the comparison indicates completion of cure.

2. The method of claim 1 including measuring the time-temperature cure data for the compound being molded in the press with a rheometer and automatically updating said data within the computer in the event of changes in the compound being molded in each press as measured by said rheometer.

3. The method of claim 1 including providing the computer with a mold temperature set point for each mold and a constant of proportionality with which a range of permissible mold temperature variation may be calculated, calculating at frequent periodic intervals in the computer the range of mold temperature variations from the set point, comparing at frequent periodic intervals in the computer the range of mold temperatures and the actual temperature, and controlling the mold heater to keep the mold temperature within the calculated range of the set point.

4. The method of claim 3 wherein the frequent periodic interval is approximately 10 seconds.

5. A method of operating a series of rubber-molding presses in conjunction with a computer, comprising:

providing the computer with time-temperature cure data for the compounds to be molded,

constantly informing the computer of the temperature of each mold,

informing the computer of the compound being molded in each mold,

constantly informing the computer of the elapsed time that the compound has been in each mold,

calculating at frequent periodic intervals in the computer the Arrhenius equation to determine the total required cure time,

comparing at frequent periodic intervals in the computer the calculated total required cure time and the elapsed time, and

opening the press automatically when the elapsed time has reached the calculated total required cure time.

APPENDIX D

Excerpts from Patent Office Rejection of December 17, 1974 (Second Application, S.N. 472,595)

Notification of Rejection(s) and/or Objection(s) (35 U.S.C. 132)

Claims	Reasons for Rejection	References	Information Identification and Comment
1-5	35 U.S.C. 112		drawn to insufficient disclosure. See PART IV, paragraph 1.
1-5	35 U.S.C. 103	AvB	A discloses a computer control of a molding process in which variables such as time and temperature are sensed and are fed to a programmed computer which compares such values with pre-stored values. As noted in col. 4, line 60—the time for opening the tire mold is indicated by a signal on line 70. B discloses a method of controlling the curing of curable articles in which the Arrhenius equation is used to calculate the relationship between the temperature and the rate of reaction. It would be obvious to use such equation for calculation in the device of A in view of B.
1-5	35 U.S.C. 103	C	C discloses an apparatus for controlling the cure of a rubber compound in which rheometric data is used to calculate the indication time period by using the Arrhenius equation which value in turn, is compared with a predetermined stored value.

Claims	Reasons for Rejection	References	Information Identification and Comment
1-5	35 U.S.C. 101 & 103	A	drawn to non-statutory subject matter. The basic concept of computer control of a rubber mold press is disclosed by A. Any novelty in claim, therefore must be based on the particular calculations performed by the computer according to a prescribed program. Such has been held to be non-statutory subject matter in Gottschalk v. Benson, 175 USPQ 673.

D and E are cited of interest but are not applied against the claims.

PART IV

1. The specification is objected to by the Examiner as containing insufficient disclosure under 35 USC 112. The instant invention is disclosed and claimed to be one involving a general purpose digital computer properly programmed to calculate the correct cure time for a rubber-molding press and to open such press accordingly. A general purpose computer by itself would be incapable of carrying out any operation until its sequence of internal interconnections has been added thereto by the preparation and loading of a program into the internal memory of the computer. The instant disclosure does not identify any program which will cause the computer to carry out the necessary functions. Although applicant has provided a flow chart, it is noted that such flow chart is not a program and only suggest [sic] operations from the point of view of desired results. The type of flow chart in the instant

application is not detailed enough to place an operative program within the hands of those skilled in the art. In some cases a flow chart may be sufficiently detailed to satisfy the disclosure requirements of section 112, but this case is not one of them.

Notice of References Cited

	Patent No.	Date	Patentee	Class	Sub-Class	Filing Date If Appropriate
A	3,659,974	5-1972	Neugroschl	264	40 X	
B	3,718,721	2-1973	Gould et al	264	40	
C	3,819,915	6-1974	Smith	235	151 X	9-17-1973
D	3,579,626	5-1971	Brittain	264	315 X	
E	3,649,729	3-1972	Davis et al	264	40	

APPENDIX E

Excerpt from Amendment to Second Application S.N. 472,595, Filed March 13, 1975

Part III, Paragraph 2

The second basis of rejection is made under Section 103 on the basis of Neugroschl in view of Gould et al.

The Examiner commented that Neugroschl disclosed a computer control of a molding process. However, a careful review of Neugroschl establishes that the computer disclosed therein provides *no control of the molding press whatsoever.* In fact, the Neugroschl tire press 1 is controlled by conventional electromechanical circuitry located in a control cabinet 30:

> "A typical controller consists of the well known timer cam in which a number of cams are mounted on an extended shaft which is turned at a constant rate. A cycle of the press and post cure inflator is con-

trolled by one full turn of the timer shaft. Cams on the shaft contact switches to operate the various press and inflator functions."

(Neugroschl, Col. 3, l. 19-24)

"Initiation of a cure cycle is accomplished by closing contacts 45 which turns on timer motor 47. During the time motor 47 operates, *which is the length of a cure cycle,* voltage is applied to the primary side of transformer 51 by lines 52, 53."

(Neugroschl, Col.3, l. 75-Col. 4, l. 4, emphasis added)

It is to be noted in Fig. 3 of Neugroschl that all of the control signals that operate the press 1 originate on the primary side of the transformers, including transformer 70, which was incorrectly cited by the Examiner as the computer control element. Fig. 3 fails to disclose any computer input to the primary side of any of the transformers. Thus, Neugroschl does not disclose and does not suggest the use of the computer to control either the timer motor 47 or any other controlling circuitry of the press. Since the patent to Neugroschl does not disclose or suggest the computer control of the present invention, its combination with the patent to Gould et al. would not produce the present invention or make the method thereof obvious.

Gould et al. taught three ways to calculate the cure time for curable articles, particularly rubber tires. The first way suggested was a numerical integration of an Arrhenius equation. (Gould, col. 2, lines 5-24). A second way was to utilize an empirical equation which differs from the present invention. (Gould, Col. 2, lines 25-29). A third way was an unspecified polynomial equation expressing the relationship between the change of properties with temperature and time (Gould, Col. 2, lines 37-39).

Although Gould mentions on [sic] passing the use of a digital computer to perform a summation of "increments of cure," his suggestion is most vague, as no details of any sort are given. (See Col. 2, lines 64-67) In fact, a careful review of the Gould et al. reference reveals it was directed to an invention quite different from the present invention. Gould et al. were concerned with certain tire curing situations allowing the insertion of a thermocouple probe directly into a tire undergoing cure in the press. Apparently, Gould et al. felt that in the cure of articles of the size and relative crudeness of tires, the deformities of the tires caused by insertion of the thermocouple was offset by a claimed increased accuracy of temperature readings. The Gould method is entirely unworkable in curing "precision molded compounds" which are the workpieces of the method of the present invention, and applicants' claims exclude Gould's use of a probe that projects into the article, calling for "constantly determining the temperature (Z) of the mold at a location closely adjacent to mold cavity."

Gould is further distinguished in that Gould relied on an analog computer to calculate cure in terms of "cure units," each cure unit being defined as the cure obtained at a given temperature for *one minute* (Gould, claim 1). The present invention provides a much more accurate calculation of cure time by *repeatedly recalculating* the Arrhenius equation "at frequent intervals during each cure" (See applicants' claim 1). As is well known in the art, modern computers are able to calculate a program cycle of the types specified by Fig. 3 of the present invention in an amount of time typically in the order of one second (See

applicants' claim 6). Thus, the present invention further patentably distinguishes over Gould.

Part III, Pargraph 3

The third basis of rejection was made under 35 U.S.C. 103 on the basis of Smith. This third reference discloses programmed digital apparatus (in block diagram only) for calculating cure time for the purpose of terminating the cure of a curable article, such as a tire. In a complex and confusing fashion, the Smith invention divided a cure cycle into an induction-reaction period wherein there is no change in mechanical property of the rubber, and a cross-linking reaction period wherein cross-linking of the molded material occurs. The present invention vastly simplifies the complex method of Smith by combining the induction reaction with the cross-linking to provide the digital computer with but one calculation to perform during each calculation cycle, there being many such cycles during the cure. The improved method of the present invention enables the digital computer to aid the control of one or numerous presses simultaneously, whereas the limited purpose block diagram apparatus of the Smith reference is clearly limited to only one press. The Smith invention is quite different from applicants'.

In addition to the foregoing reasons distinguishing applicants' invention from the Smith patent, applicants are filing herewith a Rule 131 affidavit and exhibits by which they establish a conception and reduction to practice of their invention before the effective filing date of the Smith application, being September 1, 1973. In filing the affidavit

under Rule 131, applicants do not admit or imply that the Smith reference, either alone or in combination with other art of record herein, renders their invention unpatentable. Applicants have the earlier date, and therefore are filing the affidavit anyway.

Part III, Paragraph 4

Claims 1-5 are also rejected under Sections 101 and 103 as drawn to non-statutory subject matter. The Examiner reasoned that sinced computer control of a rubber mold press was disclosed by Neugroschl, any novelty of the present invention would be in the algorithm manipulated by the computer. As explained above, Neugroschl does not disclose or suggest computer *control* of a rubber mold press, and thus a basic premise of the Examiner is erroneous. Furthermore, the present invention clearly defines a novel and unobvious method calling for steps in addition to calculation with an algorithm. For instance, claim 1 calls for "intiating an interval timer," "constantly determining the temperature Z," "*repetitively* calculating in the computer, at frequent intervals during each cure, the Arrhenius equation . . . ," and "repetitively comparing . . . each said calculation . . . and said elapsed time" to determine equivalence to open the press. These elements are not the abstract mathematical formula considered in the cited *Gottschalk v. Benson* opinion. Rather, the claims presented herein clearly define a patentable process, being one category of invention expressly enumerated in Section 101. The rejection on this ground is thought to be traversed.

Allowability of Claims

The claims of the present invention, as amended, are thought to define patentable subject matter and will now be considered. Claim 1 is expressly directed to "precision molded compounds" which cannot be distorted by, e.g., the Gould et al. method, which calls for insertion of the thermocouple into the compound. "Repetitive" computer calculations and "repetitive" comparisons synchronized with the calculations are now expressly claimed in claim 1. As now claimed, the applicants' method provides a very efficient control for the press, far more efficient than either the analog routine of Gould or the complex routine of Smith. And, as stated above, Neugroschl has no real pertinence to any of the claims because it is not a computer control invention.

Claim 6 has been added to follow claim 1. This dependent claim specifies that each calculation and comparison interval will "be no longer than approximately one second," which thereby makes it about sixty times faster than the Gould analog computer calculates its cure unit.

Claim 2 has been amended to specify that the rheometer automatically updates the computer "data base" with the "activation energy constant" of the compound undergoing molding. This is an *on line* update, rather than the manually inserted rheometric data of Smith.

Claims 3 and 4 have not been amended. They depend from claim 1 which is now thought to define patentable subject matter, and thus they are thought allowable.

Claim 5 has been amended to cover a "method of operating a plurality of rubber-molding presses simultaneously

curing precision molded compounds in conjunction with a computer . . ." Thus, for the same reasons applicable to claim 1, claim 5 patently distinguishes over the cited prior art. Indeed, claim 5 is vastly different than any of the methods of the references, which limit the computer to one press. In claim 5 the computer is "repetitively calculating" and "repetitively comparing . . . for each said press," as the presses simultaneously cure the precision molded compounds.

With this response, applicants sincerely believe this case in condition for allowance. Therefore, reexamination and reconsideration is respectfully requested.

The Examiner is invited to telephone applicants' attorney at the number below his signature, if such a call would further the prosecution of this matter.

APPENDIX F

Excerpt from Present Continuation Application S.N. 602,463 Filed August 6, 1975

These Remarks respond inter alia to the Final Rejection of the Examiner dated May 14, 1975 of the parent application, Serial No. 472,595. * * * The Examiner did not in that action reject claims 1-6 on prior art under either 35 U.S.C. 102 or 35 U.S.C. 103. Applicants infer that the Examiner has now recognized the unobvious differences of the present invention over the cited prior art and that the issue is to Sections 101 and 112.

APPENDIX G

Excerpt of Joseph D. Ekland's 2nd Affidavit Submitted with the Amendment, Filed April 21, 1976 in the present application S.N. 602,463

I, Joseph D. Ekland, being first duly sworn, depose and say: • • •

8. That the system as installed at the Van Wert, Ohio facility is considered an economic success in that Federal-Mogul Corporation has publically claimed a 20% increase in product and a 15% reduction in scrap rate.

APPENDIX H

Excerpt from Brief for PTO Board of Appeals, October 21, 1976

ARGUMENT

Although there was a rejection on art in the parent case, this rejection was withdrawn. There was also a rejection even in this continuation case, under § 112—that, too, has been withdrawn. The rejection now is § 101 alone.

APPENDIX I

Excerpt from Examiner's Answer, February 23, 1977

Description of the Invention

The invention is described on page 8 through 19 of appellants' brief.

No References Have Been Relied On

The Grounds of Final Rejection

Claims 1-11 are rejected under 35 U.S.C. 101 as being drawn to non-statutory subject matter.

Supreme Court, U. S.
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No. 79-1112

In the Supreme Court of the United States

OCTOBER TERM, 1979

SIDNEY A. DIAMOND, COMMISSIONER OF PATENTS AND TRADEMARKS, PETITIONER

v.

JAMES R. DIEHR, II, AND THEODORE A. LUTTON

ON WRIT OF CERTIORARI TO THE UNITED STATES COURT OF CUSTOMS AND PATENT APPEALS

REPLY MEMORANDUM FOR THE PETITIONER

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TABLE OF AUTHORITIES

Cases:	Page
Freeman, In re, 573 F.2d 1237	4
Gottschalk v. *Benson*, 409 U.S. 63	4
Johnson, In re, 589 F.2d 1070	4
Parker v. *Flook*, 437 U.S. 584	4
Phillips, In re, 608 F.2d 879	4
Statutes:	
35 U.S.C. 101	4
35 U.S.C. 103	3, 4
Miscellaneous:	
Patent and Trademark Office, *Manual of Patent Examining Procedure* (1980)	3

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1. Respondents contend (Resp. Br. 42–43, 18, 46) that their rubber molding process has three novel features: (1) the repetitive determination of the exact temperature in the mold; (2) the recalculation of the cure time at very short intervals; and (3) the use of a temperature probe that will not damage the precision molded product. The Patent and Trademark Office Board of Appeals found, however, that the "only difference between the conventional methods of operating a molding press and that claimed * * * rests in

those steps * * * which relate to the calculation incident to the solution of the mathematical problem or formula" (Pet. App. 24a). The Court of Customs and Patent Appeals did not disturb the Board's determination (*id.* at 13a). In this Court respondents are thus obliged to show that on the Patent Office record the Board's finding is clearly erroneous. They have failed to do so.

Respondents do not dispute that like their claims the Gould and Davis patents cited by the examiner (Pet. App. 30a) describe a repetitive determination of the exact temperature in the mold (Resp. Br. 13 n.11, 42; see Pet. App. 63a, 67a, 71a, 75a, 78a). Nonetheless, they assert that their process involves two improvements over those of Gould and Davis: first, that unlike Gould and Davis they do not use temperature probes that could damage precision products; and second, that the Gould and Davis calculation is performed only once per minute while theirs is done much more often (Resp. Br. 42). Although the later Gould and Davis patent involved inserting the probe into the molded article (Pet. App. 63a), their earlier patent claimed the very method of measuring temperature respondents describe in their specification—sensing the temperature at the surface of the article (compare Pet. App. 73a, 78a with Pet. App. 45a). Moreover, claim 7 of their later patent refers to computing the state of cure at "regular intervals or continuously" (*id.* at 72a), in other words, "at every instant" (*id.* at 68a; cf. respondents' specification, Pet. App. 41a). The prior disclosure by Gould and Davis of the very procedures here claimed by respondents to be novel undoubtedly

explains why respondents, when summarizing their invention before the Patent Office, did not even mention the advances over prior art upon which they rely in this Court (compare Resp. Br. 42–43 with Pet. App. 41a–42a). Instead, they stressed their use of a computer to improve the cure (Pet. App. 41a–42a).[1]

2. Respondents further argue (Resp. Br. 40–41) that the Patent Office must have resolved in their favor the factual issue just discussed because during the prosecution of their original application[2] they overcame an obviousness rejection under 35 U.S.C. 103 based on prior art.[3] But the examiner was required under 35 U.S.C. 103 to consider not only re-

---

[1] Respondents complain (Resp. Br. 24–26) that clerks in the Patent Office's Application Division arbitrarily assigned their application to a computer examining group while the Gould and Davis applications were assigned to a chemical examining group. This assignment, say respondents, resulted in rejection of their application and approval of those of Gould and Davis. But while the Application Division is initially responsible for assigning each application to an art group, the supervisory primary examiner in each art group must then review each application to determine if it has been properly assigned to his group. Patent and Trademark Office, *Manual of Patent Examining Procedure* §§ 903.08(a) and (d) (1980). If it does not belong in his group, the supervisory primary examiner must transfer the application to the proper group (*id.* at § 903.08(d)). As we have shown, the decision to assign respondents' application to the computer examining group was correct, for the linchpin of respondents' claimed invention is a programmed computer (see Pet. App. 5a n.3, 21a–22a).

[2] The instant application is a continuation of an earlier one.

[3] Section 103 requires the Patent Office to reject an application "if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art * * *."

spondents' method of surface sensing and repeated temperature measuring but also their claimed use of a programmed computer to recompute the cure time. He undoubtedly believed that the programming of the computer made the process sufficiently different (cf. Gould and Davis' suggestion for using a "digital computer" (Pet. App. 67a)) for respondents' invention to pass muster under Section 103.[4] This forcefully serves to highlight the importance of following the Section 101 analysis prescribed in *Parker* v. *Flook*, 437 U.S. 584 (1978), of first assuming the computer "algorithm * * * to be within the prior art" (*id.* at 594) and only then considering what remains "as a whole" (*ibid.*) to determine if it is "well known" (*ibid.*). That indeed is what the Board of Appeals did in this case (Pet. App. 21a–24a), and what the Court of Customs and Patent Appeals refused to do (Pet. App. 13a–14a & n.6).[5]

[4] Contrary to the suggestion in the American Patent Law Association Amicus Brief (at 3, 4 & n.4), a decision that the application discloses patentable subject matter will thus probably mean that the patent will issue.

[5] Respondents (Resp. Br. 29–31) and the American Patent Law Association (APLA Amicus Br. 8–11) contend that the CCPA has been evenhanded in its interpretation of *Flook* and *Gottschalk* v. *Benson*, 409 U.S. 63 (1972), because the court has reversed the Patent Office's rejections in some computer program cases and affirmed them in others. But counting cases is hardly a substitute for a careful analysis to determine whether the CCPA is properly interpreting *Benson* and *Flook*. Had such an analysis been made it would have revealed that the court is applying a different, pre-*Flook* test (see *In re Freeman*, 573 F.2d 1237, 1245 (C.C.P.A. 1978)) that requires approval of the patent under Section 101 unless all that is claimed is a mathematical formula and the claim wholly preempts the formula (see, *e.g.*, *In re Johnson*, 589 F.2d 1070, 1075–1076 (C.C.P.A. 1978); *In re Phillips*, 608 F.2d 879, 882–883 (C.C.P.A. 1979)).

For the reasons stated herein and in our main brief, the judgment of the Court of Customs and Patent Appeals should be reversed.

Respectfully submitted.

WADE H. MCCREE, JR.
Solicitor General

OCTOBER 1980

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IN THE

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SIDNEY A. DIAMOND, COMMISSIONER OF PATENTS AND TRADEMARKS, *Petitioner*

v.

JAMES R. DIEHR, II, and THEODORE A. LUTTON, *Respondents*

On Writ of Certiorari to the United States Court of Customs and Patent Appeals

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BRIEF AMICUS CURIAE FOR CHEVRON RESEARCH COMPANY IN SUPPORT OF AFFIRMANCE

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TABLE OF CONTENTS

		Page
I.	AUTHORITY TO FILE	1
II.	INTEREST OF THE AMICUS	1
III.	SUMMARY OF THE ARGUMENT	3
IV.	ARGUMENT	4
	A. Patentability Of Computer Programs Is Not At Issue	4
	B. An Invention Does Not Become Non-Statutory Just Because A Digital Computer May Be Used To Carry Out The Invention	7
	C. Petitioner Seeks A Rule Of Law That Would Preclude Patentability Of Inventions Implemented Through The Use Of Programmed Digital Data Processing Equipment	11
	1. Mathematical Expressions of Principles of Nature or Scientific Truths are the Only Algorithms Which Should Be Treated As Being In the Prior Art Under *Flook*	12
	2. Ignoring Subject Matter Recited In a Claim Is Not Treating That Subject Matter As Though It Were A Familiar Part Of The Prior Art	22
	D. Specific Processes For Dealing With Practical Technological Problems Are Patentable Subject Matter Whether Or Not Digital Data Processing Equipment Is Used In Their Practice	25
V.	CONCLUSION	27

Page

CASES:

In re Bradley and Franklin, 600 F.2d 807 (C.C.P.A. 1979) 19, 20

In re Bergy, 596 F.2d 952 (C.C.P.A. 1979) 26

In re Diehr, 602 F.2d 982 (C.C.P.A. 1979) 7

Diamond v. *Chakrabarty*, 48 U.S.L.W. 4714 (June 16, 1980) 12, 13, 17, 18, 25, 26

Gottschalk v. *Benson*, 409 U.S. 63 (1972) ..4, 11, 12, 13, 16, 19, 20, 21

Kewanee Oil Co. v. *Bicron Corp.*, 416 U.S. 470 (1974) 16

Mackay Radio and Telegraph Co. v. *Radio Corp. of America*, 306 U.S. 86 (1939) 24, 26

Parker v. *Flook*, 437 U.S. 584 (1978) 4, 11, 12, 13, 18, 19, 20, 21, 22, 23, 24, 25, 26

In re Sherwood, 613 F.2d 809 (C.C.P.A. Jan. 10, 1980) 19, 22, 24

U.S. v. *Dubilier Condenser Corp.*, 289 U.S. 178 (1933) 18

In re Walter, 618 F.2d 758 (C.C.P.A. March 27, 1980).. 8, 21, 22, 24

CONSTITUTIONAL PROVISIONS:

U.S. Const., Art 1, Sec. 8, Cl. 8 .....25, 26

STATUTES:

35 U.S.C. § 100 25

35 U.S.C. § 101 .....1, 3, 4, 7, 17, 20, 21, 22, 25, 26

35 U.S.C. § 102 .....25, 26

35 U.S.C. § 103 .....25, 26

35 U.S.C. § 112 19

Page

OTHER AUTHORITIES:

In the Matter of An Application by IBM for the Revocation of Letters Patent No. 1,352,742 in the name of Frederick Nymeyer (Royal Courts of Justice of the United Kingdom 1978) 5, 6

Patents Act of the United Kingdom, Patents Act 1949, Chapter 87, Paragraph 101 6

Patents Act of the United Kingdom, Patents Act 1977, Chapter 37, Paragraph 1 6

J. Quirt, "Socal Is Looking Homeward," *Fortune,* March 10, 1980, p. 66 2

Robinson on Patents, Vol. 1, Section V. §§ 133-143 (1890) 12

S. Rep. No. 1979, 82nd Cong., 2d Sess. 5 (1952) 21

Technology Assessment & Forecast, Eighth Report December 1977, Government Printing Office Stock No. 003-004-00550-5 .....16, 17

U.S. Patent and Trademark Office, Classification Definitions, Classes 367 (Sept. 1979) and 364 (June 1977) 10

No. 79-1112

IN THE

Supreme Court of the United States

OCTOBER TERM, 1979

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On Writ of Certiorari to the United States Court of Customs and Patent Appeals

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BRIEF AMICUS CURIAE FOR CHEVRON RESEARCH COMPANY IN SUPPORT OF AFFIRMANCE

I. AUTHORITY TO FILE

This brief *amicus curiae* is presented by Chevron Research Company under Rule 36.2 of this Court. Letters of consent from the parties are on file with the Clerk of the Court.

II. INTEREST OF THE AMICUS

Chevron Research Company is a wholly owned subsidiary of Standard Oil Company of California and owns the patent application involved in *Diamond* v. *Sherwood,* No. 79-1941. The seismic exploration invention of this Chevron patent application was held to be unpatentable subject matter under 35 U.S.C. § 101 by the Patent and Trademark Office (PTO).[1] This decision was reversed by the United

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[1] The invention relates to gathering and processing seismic data in which events in the gathered field data (side by side wiggly lines) are identified with exact locations of reflectors deep within

States Court of Customs and Patent Appeals (C.C.P.A.) and a petition for a writ of certiorari was filed by the government. The petitioner requested that consideration of the petition be held pending the decision in *Diamond* v. *Diehr and Lutton,* No. 79-1112 on the basis of petitioner's argument that the outcome of *Diehr* will control *Sherwood.*[2] The issues in *Diehr* are related to those in *Diamond* v. *Bradley and Franklin,* No. 79-855, which is to be argued at the same time.

Chevron's immediate interest lies in assisting the court toward correct decisions on issues which may be of importance to Chevron's rights in *Sherwood.* Also the decision sought by the government potentially would impact adversely the validity of many already existing patents and diminish future patent incentives in an important field of technology where Chevron has long been active and where patents are significant.[3]

The issues of interest to Chevron relate to what kinds of inventions cannot, because their subject matter is not

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the earth. Such a process and variants thereof, provide a final pattern of reflectors that precisely indicate likelihood of hydrocarbon deposits justifying the spending of millions of dollars to drill a well. "[Standard Oil Company of California's] first well in Hibernia . . . cost $33 million, the most Socal has ever spent on a single hole, and it was drilled after a careful analysis of Mobil's seismic data. Notes Alexander Massad, Mobil's executive vice president for exploration and production: 'Obviously what their people saw [in the data] was something different from what we saw.'" J. Quirt, "Socal Is Looking Homeward," *Fortune,* March 10, 1980, at 73.

[2] In documents filed in *Sherwood,* Chevron has explained that the alleged similarity is due to the petitioner's incorrect perception of the issues in the case.

[3] "Socal has raised its exploration and production budget again in 1980, and it expects to spend somewhere between $1.7 billion and $2 billion." J. Quirt, "Socal Is Looking Homeward," *supra,* at 67.

embraced within the definition of 35 U.S.C. § 101, be patented even though they are novel and nonobvious. On these issues Chevron supports affirmance of the holdings below to the effect that the subject matter before the Court is within the statute. Chevron takes no position on the novelty or nonobviousness of respondent's invention.

III. SUMMARY OF THE ARGUMENT

It is fundamentally wrong to consider an invention unpatentable solely because a programmed machine is used to carry out the invention and the program for the machine represents an algorithm. Algorithms, as step-by-step processes for obtaining a particular result, have never been treated as *per se* unpatentable. Algorithms carried out by a programmed computer should not be subject to such treatment.

The underlying rationale of the body of case law differentiating patentable from unpatentable subject matter does not lie in the characterization of claimed subject matter as algorithms, computer programs or the like. Two ideas are involved. One is that, although newly discovered, things that have always existed should not be removed from the public domain. The other is that abstract or general ideas, as opposed to concrete solutions to technological problems, fall outside the area of intended operation of the patent system. The granting of patent protection on computer implemented inventions should not be foreclosed on any other basis.

In the context of inventions that involve the use of programmed computers, the C.C.P.A. has attempted to develop a reasoned approach to the initial inquiry required by 35 U.S.C. § 101. Mindful of this Court's prior decisions, the C.C.P.A. approach treats laws of nature, physical phenomena and abstract ideas as though they were a familiar part of the prior art while treating the claimed subject matter as a whole. Parts of claims are not ignored or set aside.

Rather the analysis takes into account the presence of the unpatentable principle or idea in the claim through its relationship to other claimed structure or process steps. The result is consistent with this Court's decisions; it rewards appropriate inventions such as innovative applications of principles to practical uses without removing the underlying principles from the public domain.

IV. ARGUMENT

A. Patentability of Computer Programs Is Not At Issue

The petitioner maintains that the respondents in *Diehr,* in *Bradley* and in *Sherwood* are each attempting to patent a "computer program" and that computer programs are unpatentable. In all of these cases the petitioner has framed its questions in identical "computer program" terms.

This Court has never decided that computer programs are unpatentable. The majority in *Gottschalk* v. *Benson*[4] specifically declined to do so. Likewise, in *Parker* v. *Flook,*[5] the Court refused to so hold. Chevron urges this Court *not* to decide whether computer programs *per se* are or are not patentable, for such a decision is not required by the facts of any of the cases now before the Court. The only common question presented by the facts of *Bradley* and *Diehr* (and *Sherwood*) is whether implementation of a process or machine invention by means of a digital computer, in and of itself, renders the process or machine invention unpatentable subject matter under 35 U.S.C. § 101. Chevron respectfully submits that the answer to this question is, no, and that each case now before the Court must be individually judged not by some unworkable standard based upon the presence or absence of "algorithms", "equations", "programmed algorithms", "computer programs" or the like, but by whether or not each patent application seeks to

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[4] 409 U.S. 63 (1972).

[5] 437 U.S. 584 (1978).

remove from the public domain an unpatentable principle of nature, physical phenomenon or abstract idea.

It is unfortunate that petitioner has made interchangeable use of words that have different meanings. For example, "algorithm', "computer program", "algorithm for a computer program" and "programmed algorithm" are used synonomously in petitioner's briefs.[6] Yet these words are not synonomous.

One must be particularly careful to distinguish between a "computer program" and what the computer does. The computer program is a series of instructions telling the computer how to operate to produce a desired result.[7] The computer can only manipulate binary signals (digits) so the operations may consist of receiving and storing infor-

---

[6] *See,* for example, p. 8 of petitioner's brief in *Bradley* where the terms "computer program" and "algorithm" are seemingly used synonomously. Further, on the bottom of p. 13 of the same brief the phrase "algorithm for a computer program" is used. In its *Diehr* brief, the term "programmed algorithm" is used at p. 11. A *computer program* is a series of operational instructions in a language and form that are useable by a computer. An *algorithm,* in general, is a logical series of steps that leads from one point to a desired result. The algorithm in computer terms is not the computer program; it is more akin to the outline for the operations which must be performed by the computer to arrive at the desired result. It may be expressed in words or mathematical formulae but is commonly expressed as a combination of the two. The flowchart narrative and the computer program at pages 17-18 of the Appendix to petitioner's brief in *Diehr* illustrate the difference between a "computer program" and what might be termed the "algorithm" underlying the program. Apparently, petitioner would use the term "mathematical algorithm" to describe steps 33, 41, and 52 of the flowchart narrative. Petitioner seems to use the word "equation", in its mathematical sense, as a mathematical formula. In this sense, "equation" and "mathematical algorithm" may be synonomous.

[7] *In the Matter of An Application by IBM for the Revocation of Letters Patent No. 1,352,742 in the name of Frederick Nymeyer,* decided October 16, 1978 (Appendix A, p. 6a).

mation in a register in the form of digits; receiving and counting a series of digits and transferring stored digits from one register to another on the appropriate count, or comparing the digits in two registers. But in performing these operations, the computer may be amplifying a signal, comparing an actual temperature with a desired temperature or performing a variety of other process steps that are apparent neither from a program listing of the steps the computer performs to complete each task nor from the digital manipulations performed within the computer.

In the context of machine inventions, the Patents Appeal Tribunal of the British Courts of Justice has likened the computer program to "a cam shaped according to certain formulae so that, when fixed into a machine, it controls the latter in a certain way" (Appendix A, p. 8a). A computer with a specific program in it is described as "a piece of machinery which, by reason of the fact that certain perforated cards are placed in it, is constrained to function in a certain way and produce a certain result which is desired" (Appendix A, p. 9a). As such, the British Patents Appeal Tribunal views the computer when loaded with a particular program as "a manner of manufacture" which never existed before.[8]

In reaching this conclusion, the British Tribunal recognized that the computer *per se* was old and that the ideas are not patentable (Appendix A, p. 5a). But it was also recognized that there is a difference between a "computer

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[8] This case and others referred to in it were decided under the Patents Act of the United Kingdom, Patents Act 1949, Chapter 87, Paragraph 101. Recent revision of this Act may or may not have changed the test of patentability under British law (Appendix A, p. 3a), since the Patents Act 1977, Chapter 37, Paragraph 1 declares that a "program for a computer" is not an invention for the purposes of the Act "only to the extent that a patent or application for a patent relates to the [program for a computer] *as such.*" (emphasis added)

program" and a "programmed computer", the former term being something akin to a writing and the latter term being a machine having a fixed mode of operation. In *Diehr* and *Bradley,* however, the petitioner has failed to distinguish between programs, programmed machines and what the programmed machine does (as opposed to how it operates). As a result, the petitioner is suggesting that the Court must decide the issue of "patentability of computer programs". This is a fundamental misconception. The real issue to be addressed is whether in *Diehr* and *Bradley* (and eventually *Sherwood*) the applicants for patent are claiming an abstract idea, a principle of nature or a naturally occurring physical phenomenon, for these are the only categories of *subject matter* this Court has ever declared unpatentable.

B. An Invention Does Not Become Non-Statutory Just Because A Digital Computer May Be Used To Carry Out The Invention

An invention is itself a product of the mind, distinguishable as such from the particular equipment used to practice the invention.

Implementation of a given invention usually can take a variety of specific forms, all of which depend upon the state of technology at the time of implementation. Machine implemented processes for curing rubber and apparatus for controlling the internal operations of machines have always been patentable subject matter. They should be no less patentable when a computer is involved than when the work is done by some other means. The focus in determining patentability should be on what is being done by the machine and not on how it is being done. The C.C.P.A. recognized this when it stated: "The statutory nature of a process or method [or machine] does not depend, under § 101, on the means used to carry it out."[9]

---

[9] *In re Diehr,* 602 F.2d 982, 987-988 (C.C.P.A. 1979).

It must be recognized that the programmable digital computer is merely a new tool for doing what was formerly done with specific mechanical or electrical *hardware.* The steps or machine functions performed by the programmed computer are no different from those performed by hardware; they only appear to be different because of the nature of digital computers. To use a programmed computer, the functions to be performed must be described in the language of mathematical operations carried out on data expressed as digits, since the computer ". . . is characterized by its ability to process data, usually by executing mathematical operations on the data at high speeds".[10] Thus, the function of attenuating a signal which, in *hardware,* is accomplished by a fixed arrangement of circuit components (e.g., an attenuator), may be carried out on a digital computer by dividing a number representing signal magnitude by another number representing the desired attenuation. Similarly, the function of amplifying a signal, accomplished in hardware by a fixed arrangement of circuit components (an amplifier), may be accomplished in a digital computer by multiplying the signal (converted to a number so the computer can handle it) by the desired amplification factor (another number). Thus, the operations performed within the computer can be characterized as "mathematical", but to characterize the functions performed as mere mathematical exercises is ". . . misleading because it ignores what the computer is doing, concentrating instead on how it is being done".[11] Signal processing (e.g., attenuating, amplifying, filtering, etc.) is no less a technological endeavor when expressed and performed with digital circuits on a discrete, mathematical, level than when accomplished by fixed "analog" circuits.

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[10] *In re Walter,* 618 F.2d 758, 764 (C.C.P.A. March 27, 1980).

[11] *Id.* at 769.

The petitioner apparently has never questioned the thousands of patents that have been issued by the examiners in the Patent Office on *circuits* or processes carried out by *circuits* that perform signal attenuation or amplifying functions. However, when these very functions are performed by a digital computer under instructions of a program that necessarily expresses these functions in a different form, the petitioner would take these inventions out of the technological arts and characterize them as unpatentable "algorithms", or as "computer programs".

The *Sherwood* case illustrates quite clearly the danger of this biased treatment of computer implemented inventions. Geophysicists have long used seismic techniques to locate oil bearing formations beneath the ground. Patent protection has always been available for inventions in this field.[12] It is only recently as the use of digital computers has become more widespread in this field that the patentability of such subject matter has been questioned.

In the early seismic signal processing patents, fixed arrangements of circuit components (analog systems) are disclosed to perform the claimed methods. In the later patents, digital processing techniques are used. The availability of such techniques seems to have lead to the realization that there frequently is little reason to use fixed circuitry to process seismic signals because the programmed digital computer is faster, less expensive, and more versatile. The process steps applied to this art (sonogramming, inverse sonogramming, etc.) are no more "mathematical" when done on a computer than when done by *hardware*, yet there is no room for a reasoned approach if everything done by the computer is to be ignored as an unpatentable "algorithm" as in petitioner's test.

---

[12] We are lodging with the Clerk of the Court copies of a number of patents in the field and the PTO class definitions referred to herein.

The Patent Office classification system officially embraces classes of subject matter relating to seismic signal processing, both with and without computer involvement. Class 367—"Communication, Electrical: Acoustic Wave Systems and Devices"—contains thousands of patents on seismic exploration and contains a subclass (21) entitled "Signal Processing" (for processing signals representative of acoustic waves to identify information in the signals pertaining to underground formations). Class 364—"Electrical Computers and Data Processing Systems"—contains numerous patents in which programmed computers are used in processes including, in subclass 420, processes wherein the data processing system or calculating computer is designed for or used in the study of the earth and/or related sciences.[13] In the official classification definitions there is even a recognition that the nature of a "functional system or element [of a claim]" does not change merely because it "is simulated by a programmed data processor or calculator. . . ."[14]

The Patent Office examiners are prepared and able to examine applications on these inventions. Such applications have long been examined and allowed. It clearly would be wrong to exclude them now merely because the inventions are carried out in practice through the use of digital computers. A more rational approach that preserves

---

[13] U.S. Patent and Trademark Office, Classification Definitions, Classes 367 (Sept. 1979) and 364 (June 1977). There is even a subclass of computer applications (subclass 400) defined as "Subject matter under the class definition wherein the data processing system . . . is designed for or utilized in a particular art device system, process, or environment. . . ."

[14] *Id.* See the suggestion that when searching for prior art one should look for functional equivalency of computer elements and:

> "E. Search the class and subclass providing for a functional system or element in addition to this subclass when the functional system or element is simulated by a programmed data processor or calculator. . . ." Class Definitions, Class 364, June 1977, p. 364-3.

subject matter always considered patentable must be formulated.

C. Petitioner Seeks A Rule Of Law That Would Preclude Patentability Of Inventions Implemented Through The Use Of Programmed Digital Data Processing Equipment

What the Patent and Trademark Office seeks in *Diehr* is a decision spelling out how the lower courts must analyze a particular type of invention in determining whether it is of a character such that if new and nonobvious, it might properly be patented.

Consideration of the Patent and Trademark Office brief in *Diehr* along with its statements in *Bradley* and in *Sherwood* provides a fairly clear picture of the rule it wishes the Court to embrace. This would require:

> (1) identifying the component of the claimed invention that in practice would involve the programming and use of digital data processing equipment;[15]
>
> (2) setting aside (i.e., ignoring) the component identified in (1) and examining the remaining portions of the claimed invention in light of the prior art to determine whether any inventive contribution is represented by these portions without reference to the component identified in (1).

If (2) did not reveal an inventive contribution, the Patent and Trademark Office would conclude that the claimed invention was of a nature such that a patent could not properly be granted even if the claimed invention as a whole were new and nonobvious.

Petitioner purports to derive the proposed rule from the decisions of this Court in *Benson* and *Flook*.

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[15] The term "computer" is used popularly with reference to such equipment, but this suggests a connection with mathematics which does not in fact exist. The data processed need not be mathematical data although the manner of processing the data in a computer involves the use of numbers.

1. *Mathematical Expressions of Principles of Nature or Scientific Truths are the Only Algorithms Which Should Be Treated as Being In The Prior Art Under Flook*

In 1890, William C. Robinson in his treatise *Robinson on Patents* described the nature of the inventive act and exhaustively explored the bases for the prohibition against patenting what we now call principles of nature, ideas and physical phenomena.[16] Robinson recognized that everything in the material world operates in accordance with natural forces (principles of nature). He stated:

> "In one sense, the word "principle" denotes the physical force employed by an invention. The other appellations given to this force are very numerous, and most of them are wholly inappropriate. It has been called "an elementary truth," "a principle of science," "a property of matter," "a law of nature," the "root and ground of science;" but the idea which underlies these phrases is sufficiently apparent, and is neither less nor more than that of some natural power or energy, which operates with uniformity under given circumstances, and may thus be contemplated as obedient to law. (footnote omitted). *A principle, in this sense, is a necessary factor in every means which produces physical effects, whether such means be natural or artificial,* and it is generally this which makes the chief impression on the senses of the observer; but it is in itself no true invention, nor can it be protected by a patent." § 135, pp. 193-5 (emphasis added).

The central thrust of the *Benson* and *Flook* decisions was a confirmation, in the context of inventions involving computer technology, that "laws of nature, physical phenomena, and abstract ideas . . . [are] not patentable."[17]

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[16] *Robinson on Patents,* Vol. 1, Section V, §§ 133-143 (1890).

[17] *Diamond* v. *Chakrabarty,* 48 U.S.L.W. 4714, 4715 (June 16, 1980).

As the Court explained recently in *Diamond* v. *Chakrabarty*:

> ". . . Einstein could not patent his celebrated law that $E = mc^2$; nor could Newton have patented the law of gravity. Such discoveries are 'manifestations of . . . nature, free to all men and reserved exclusively to none.' " [18]

Although the Court in *Flook* "carefully scrutinized the claim at issue to determine whether it was precluded from patent protection under 'the principles underlying the prohibition against patents for "ideas" or phenomena of nature'," [19] the petitioner's brief here makes no reference to abstract ideas or laws of nature and does not deal at all with the principles which foreclose patents in these areas. Instead, petitioner has chosen, unjustifiably, to view *Benson* and *Flook* as applicable to everything that might be termed an "algorithm' or a "programmed algorithm", provided only that the algorithm be used in digital data processing equipment.

In each of *Benson* and *Flook* the Court used the term "algorithm" to refer to something specifically described as a "mathematical formula",[20] and "algorithm" was said to mean "[a] procedure for solving a given type of mathematical problem." However, the term is given quite a different meaning in the petitioner's brief here without a clear explanation of either the fact of the shift or the reason for it.

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[18] *Id.* at 4715-16.

[19] *Id.* at 4717.

[20] Note, for example, the parenthetical usage in the *Flook* opinion of "or mathematical formula" to qualify "algorithm": "Reasoning that an algorithm, or mathematical formula, is like a law of nature, *Benson* applied the established rule that a law of nature cannot be the subject of a patent." 437 U.S. at 589.

The invention at issue in *Diehr* does involve a mathematical formula, the Arrhenius equation. But the Arrhenius equation is not the "algorithm" the Patent and Trademark Office wants to have "set aside" (Brief for Petitioner at 7) before a determination is made as to whether the claimed invention is of a type which is ineligible for patent protection even if it is new and non-obvious. The "algorithm" which the Patent and Trademark Office wants to set aside is the series of method steps by which the patent applicant in *Diehr* sought to operate a mold through a specified way of applying the principle expressed in the Arrhenius equation.

This important distinction can be clarified perhaps by dwelling for a moment on the technological aspects of the *Diehr* invention. The patent applicant did not claim to have discovered the Arrhenius equation or that it could be used in controlling a molding machine. Rather, the invention proceeded from a premise that the relationship expressed in the Arrhenius equation could *not* be applied directly to a molding process because real world molds did not in practice operate at a fixed temperature throughout a curing cycle. How then to obtain uniformly cured products in spite of the practical impossibility of duplicating the ideal conditions under which cure time could be computed in accordance with the known relationships governing rate of cure? The *Diehr* answer was a method in which one concurrently (1) kept track of the time elapsed after the closing of a mold and (2) made repeated measurements of mold temperature external of the molded product itself and individual cure time computations based on those measured temperatures. Each computed cure time was in turn compared with the then existing elapsed time until finally there was a match between elapsed time and the current computed cure time, and then the mold was opened so the cured article could be removed.

It is this method, not the Arrhenius equation, that petitioner's brief calls a "programmed algorithm [which] is respondents' only contribution."[21] Thus, petitioner's real premise as to non-statutory subject matter relates not to "law of nature" or "mathematical formula" considerations, but rather to the "fixed step-by-step procedure for accomplishing a given result"[22] which the *Diehr* patent application says should be carried out in practice through the use of digital data processing equipment.

Any doubt on this point is removed by reference to *Sherwood*, which petitioner equates to *Diehr*. Although the invention there obviously is far removed from a law of nature or a mathematical formula, petitioner again calls a process an "algorithm" and contends that it is not statutory subject matter for this reason. The preferred way of practicing the *Sherwood* process is through use of digital data processing equipment but the patent application also describes in detail a system of electrically driven mechanical devices (cams, gears, wheels, etc.) for carrying out the invention. The claims cover both modes of implementation.[23]

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[21] Brief for Petitioner at 11.

[22] Brief for Petitioner at 6, n.12, *Bradley* (defining "algorithm"). Brief for Petitioner in *Diehr*, at p. 7, n. 4, refers the reader to the Bradley brief for this definition.

[23] The *Sherwood* claims at one time were indicated by the Patent and Trademark Office to be allowable, apparently in momentary recognition that the law provides no justification for a distinguishing between electromechanical implementation and digital data processor implementation of an invention. The Patent and Trademark Office still does "not . . . suggest that 'a step-by-step procedure for obtaining a given result' [citing source for this definition of algorithm] necessarily is unpatentable as an algorithm when no computer program is involved. In other contexts, a description of a patentable process could be similarly characterized." Brief for Petitioner at 12, n. 18, *Bradley*. Since a single invention cannot be both statutory and non-statutory subject matter, the Patent and Trademark Office now refuses patents on inventions that would not be challenged except for the fact that digital data

The *Sherwood* invention is a new seismic signal processing system used in locating oil and gas deposits. Within the field referred to as geophysical prospecting,[24] seismic signal processing is an established technology in which inventions have been made and patents have been granted for over fifty years.[25] Its practical importance in these

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processing equipment is the best mode for commercializing them. That which would be viewed as a patentable process if practiced only by electromechanical devices is considered by the Patent and Trademark Office as an unpatentable algorithm if digital data processing equipment is preferred.

[24] *Technology Assessment & Forecast*, Eighth Report, December 1977, Government Printing Office Stock No. 003-004-00550-5 [hereinafter cited as *Forecast*], prepared by the Patent and Trademark Office, outlines the state of this technology with particular reference to the many patents that have been granted and emphasizes its practical importance: "[G]eophysical exploration . . . is an area of wide spread interest and impact. Over $1 Billion was spent in worldwide geophysical hydrocarbon exploration in 1976 alone; reflecting the dependency of most nations on oil and gas (the demand for which is sharply increasing as the supply is decreasing) to supply the major part of their energy needs." *Id.* at 45 (footnote omitted). A copy of this Patent and Trademark Office forecast is being lodged with the Clerk of this Court.

[25] *See Forecast, supra*, at 85-97, for a discussion of this subject matter by Patent Examiner Moskowitz. It was Examiner Moskowitz who rejected the *Sherwood* invention as nonstatutory because it "has as its best mode application by programmed digital computer", professing a belief that "[t]he policy basis for . . . [this Court's decision in *Benson*] . . . precludes patentability where . . . the invention comprises a program and algorithm utilized in conjunction with a digital computer." Petition at 39a, *Sherwood*. The disabling effect of this view of *Benson* on patent incentives in this important technology is attested by Examiner Moskowitz, reporting that "[t]he *Benson* decision resulted in *a dramatic decrease in the number of applications* directed toward geophysical computer programs, algorithms and processing formulae." (*Forecast* at p. 91, emphasis added). Hence, under the Patent and Trademark Office view of *Benson*, crucially important technology which had been subject to the stimulating influence of the patent system now has been withdrawn from the reach of that system.

times of scarce oil is clearly demonstrated by a comparison of Figures 7 and 8 from the patent application.[26] Figure 7 may be viewed as the starting point for the invention, a conventional seismic time section, while Figure 8 represents the new product created by the inventor's distinctive way of combining the many wiggly traces of Figure 7 and shifting ("migrating") portions of the signals to new locations. This new product shows, within the circle added to Figure 8, a "fault" location not detectable at all from the pre-invention Figure 7 material. Locating faults is of significance in finding oil and gas.[27]

Promoting inventions of this type promotes the progress of the useful arts as intended in the Constitution. "The patent laws promote this progress by offering . . . an incentive for . . . inventiveness and research efforts." *Chakrabarty, supra,* at 4715, where the Court adopted the expression from *Kewanee Oil Co.* v. *Bicron Corp.,* 416 U.S. 470, 480 (1974) that "[t]he productive effort thereby fostered will have a positive effect on society through the introduction of new products and processes of manufacture into the economy, and the emanations by way of increased employment and better lives for our citizens."

Chakrabarty also noted as to § 101 of the statute: "The subject matter provisions of the patent law have been cast in broad terms to fulfill the constitutional and statutory goal of promoting 'the Progress of Science and the useful Arts' with all that means for the social and economic benefits envisioned by Jefferson." [28] Recognizing that courts

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[26] These drawings are reproduced in Appendix B. Petition at 1a-63a, *Sherwood,* contains a reproduction of the claims and portions of the Sherwood patent application.

[27] *Forecast, supra,* at 86 mentions faults as one of several "structural features which are associated with accumulations of gas and oil."

[28] 48 U.S.L.W. at 4717.

"should not read into the patent laws limitations and conditions which the Legislature has not expressed",[29] the Court found the micro-organism invention before it to be patentable subject matter: "[The] claim is not to a hitherto unknown natural phenomenon, but to . . . a product of human ingenuity. . . ." [30]

Of course, the seismic signal processing system of *Sherwood* also is the result of human ingenuity rather than a physical phenomenon that had "always existed" [31] but only recently been discovered by man. The seismic traces themselves are brought into being by human action and they are processed in a manner devised by man to product a new technological product (Figure 8) having qualities never present before.

This is not to say, however, that no mathematical equations are even involved in the practice of the *Sherwood* invention. Algebraic equations that deal with elemental phenomena (e.g., speed, reflection angles, etc.) of sound wave movements in the earth are used in connection with some aspects of the invention. Formulae such as these necessarily underlie engineering work of many types. They represent fundamental relationships only, however, and do not tell how the traces from many geophones can be combined and portions of the signals migrated to produce a depth section product revealing fault formations and the like. The *Sherwood* invention rests not upon a relationship that always has existed in nature, but, rather, upon the human application of a variety of operations combined in a particular manner to solve a technological problem. It

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[29] *U.S.* v. *Dubilier Condenser Corp.*, 289 U.S. 178, 199 (1933).

[30] *Chakrabarty*, 48 U.S.L.W. at 4716.

[31] *Flook*, 437 U.S. at 593, n.15: "The underlying notion [why § 101 was not intended to make the discovery of natural phenomena eligible for patent grants] is that a scientific principle . . . reveals a relationship that has always existed."

simply is not relevant to patentability to inquire as to whether man, in addition to devising the process itself, also has devised a mathematical description of it.

Nevertheless, in *Sherwood* as in *Diehr* and *Bradley* the petitioner argues in "algorithm" terminology that suggests a close relationship with mathematics. The "computer-implemented algorithm" [32] is not a mathematical formula at all but is rather an elaborate step-by-step procedure by which the seismic traces are processed. It is, in short, that entire sequence of operations for which digital data processing equipment would be used in a preferred way of practicing the invention commercially.

In neither *Diehr* nor *Sherwood* does the government give any explanation for its attempted application of *Benson* and *Flook* language, offered by the Court in the context of essentially mathematical subject matter, to different kinds of algorithms. However, the real position of the government is exposed in *Bradley* where the PTO "did not . . . direct attention to any specific formula . . . or . . . mathematical calculations . . ." [33] but instead contended that *everything* done by a *computer* (digital data processing equipment) is necessarily a mathematical operation.[34]

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[32] Petition at 7, *Sherwood.*

[33] *In re Bradley and Franklin,* 600 F.2d 807, 811 (C.C.P.A. 1979).

[34] *Id.*

The government repeats this contention in its brief to this Court in *Bradley,* and erroneously suggests at p. 14, n.21, that the C.C.P.A. subscribed to its view in later deciding *In re Sherwood,* 613 F.2d 809 (1980). However, the passage quoted was written in a wholly different context. Incredible as it may seem, the PTO before the C.C.P.A. contended not only that the invention *was a computer program* (and therefore unpatentable subject matter in its view), but also that the patent application failed to satisfy the "best mode" requirement of 35 U.S.C. § 112 because *it did not disclose a computer program* for the preferred implementation of the invention. The passage quoted by petitioner actually dealt with

This contention is without force. That mathematical expressions may be used to describe and characterize the internal operations of digital data processing equipment is meaningless. Words also can be used to describe the same events, and equations can be used to describe all sorts of things. As the C.C.P.A. pointed out:

> "[The PTO] analysis confuses *what* the computer does with *how* it is done. It is of course true that a modern digital computer manipulates data, usually in binary form, by performing mathematical operations, such as addition, subtraction, multiplication, division, or bit shifting, on the data. But this is only *how* the computer does what it does. Of importance is the significance of the data and their manipulation in the real world, i.e., *what* the computer is doing. It may represent the solution of the Pythagorean theorem, or a complex vector equation describing the behavior of a rocket in flight, in which case the computer is performing a mathematical algorithm and solving an equation. This is what was involved in *Benson* and *Flook*. On the other hand, it may be that the data and the manipulations performed thereon by the computer, when viewed on the human level, represent the contents of a page of the Milwaukee telephone directory, or the text of a court opinion retrieved by a computerized law service. Such information is utterly devoid of mathematical significance. Thus, the board's analysis does nothing but provide a quick and automatic negative answer to the § 101 question simply because a computer program is involved." (emphasis in original).[35]

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the best mode contention. The C.C.P.A. was explaining its view that the Sherwood disclosure of an electromechanical system for implementing the invention was so thorough that a person skilled in the art would have no trouble programming digital data processing equipment to accomplish similar operations if desired. The court was not discussing § 101 or what subject matter is eligible for patenting or what operations are mathematical.

[35] *In re Bradley and Franklin*, 600 F.2d at 811-12.

Thus, it will be seen that the subject matter petitioner seeks to have removed from the reach of the patent system is not limited to any of the categories which the Court has heretofore considered to be excluded. There is no justification for concluding that every "step-by-step procedure for obtaining a given result" (petitioner's meaning for *algorithm*) is a mathematical formula, or a law of nature, or a physical phenomenon, or an abstract idea whether in a programmed computer context or some other. Such a conclusion "would have the effect of totally reading the word 'process' out of § 101, since any process is a step-by-step procedure to arrive at a given result." [36] Nor is there any reason for concluding that such subject matter is outside the categories of patentable subject matter defined broadly by Congress to "include anything under the sun that is made by man." [37]

The C.C.P.A. has attempted to develop an appropriate definition of the claim "component" which *Flook* dictates be treated as being in the prior art. The definition arrived at appears to be based on the C.C.P.A.'s observation that:

> "[T]he common thread running through prior decisions regarding statutory subject matter is that a principle of nature or scientific truth (including any mathematical algorithm which expresses such a principle or truth) is not the kind of discovery or invention which the patent laws were designed to protect." [citing, *inter alia, Benson*].[38]

Thus, the mathematical expressions of principles of nature or scientific truths are claim components to be treated as being in the prior art. This should not mean that works of man or manipulations of man-made phenomena, though

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[36] *In re Walter*, 618 F.2d 758, 764-65, n.4 (C.C.P.A. March 27, 1980).

[37] S. Rep. No. 1979, 82d Cong., 2d Sess., 5 (1952).

[38] *Walter*, 618 F.2d at 765.

expressable as mathematical formulae, are to be treated as being in the prior art.[39]

2. *Ignoring Subject Matter Recited In A Claim Is Not Treating That Subject Matter As Though It Were A Familiar Part Of The Prior Art*

The petition filed by the government in *Sherwood,* No. 79-1941, contains a succinct passage that displays the PTO view of how a patent claim containing a reference to non-statutory subject matter is to be examined. Assuming that a "computer-implemented algorithm" is non-statutory subject matter, the petition describes as proper a PTO action that simply ignored the subject matter:

> "[T]he Board properly applied the test laid down in *Parker* v. *Flook:* it set aside the computer-implemented algorithm, found everything else in the claims to be well-known, and concluded that the claims did not recite patentable [statutory] subject matter." (Petition at 7, *Sherwood*).

Similar language is used by the petitioner in describing what the PTO did in *Diehr.*[40]

Page 7 of petitioner's brief in *Diehr* reveals the supposed support in *Flook* for this PTO position to be the passage:

> "Respondent's process is unpatentable under § 101 not because it contains a mathematical algorithm as one component, but because once that algorithm is assumed to be within the prior art, the application, considered

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[39] Thus, for example, in *In re Sherwood,* only mathematical expressions of geophysical principles are treated as algorithms under the *Walter* analysis.

[40] "[The PTO] identified and put aside the computer implemented algorithm in the claims and considered whether what remains is old in the art. . . . It found that everything in Diehr's claim except that algorithm was 'conventional'. . . . It concluded that Diehr was attempting to patent an unpatentable algorithm embodied in a computer program. . . ." (Petition at 8, *Diehr,* No. 79-1112).

> as a whole, contains no patentable invention. Even though a phenomenon of nature or mathematical formula may be well known, an inventive application of the principle may be patented. Conversely, the discovery of such a phenomenon cannot support a patent unless there is some other inventive concept in its application." (437 U.S. at 594).

Of course, we do not agree that what the petitioner labels a "computer implemented algorithm" in *Sherwood,* is at all like what the Court in *Flook* considered to be part of the prior art. The Court was talking about a principle or phenomenon of nature (expressed by way of a mathematical formula), and, the Court stated elsewhere in *Flook* the belief "that a scientific principle . . . reveals a relationship that *has always existed.*" [41] Thus, the Court was treating as prior art only that which had always existed; it was not licensing a trip into a fairyland where new subject matter can be treated as old when in fact it never existed before.

However, the difficulties associated with treating the new as old are side-stepped by petitioner. Instead of considering subject matter as part of the prior art, the only suggestion which could possibly be derived from *Flook,* petitioner proposes to *ignore* the subject matter altogether. According to petitioner, the claim limitations dealing with the computer-implemented algorithm are to be *"set aside"* [42] or *"put aside"* [43] or "separated from the rest of the claim".[44] After the limitations pertaining to the computer-implemented algorithm have been excised from the text, what remains of the claim must then be analyzed.[45]

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[41] 437 U.S. at 593, n.15 (emphasis added).

[42] Petition at 7, *Sherwood;* see p. 22, *supra.*

[43] Petition at 8, *Diehr;* see note 40, *supra.*

[44] Petition at 8, *Bradley,* No. 79-855.

[45] *Id.*

Not even prior art elements are treated so harshly. Old elements are found in nearly all patent claims, and there is no authority for ignoring them. Some, perhaps all, inventions contain *no* new elements, but are rather new combinations of old elements cooperating with one another to produce a new effect of some kind. Petitioner's drastic proposal that one read out of patent claims all those portions which would be implemented by digital computers clearly cannot be tied to the teachings of *Flook*. Although treating phenomena of nature as in the prior art, *Flook* not only failed to suggest that limitations in patent claims to such phenomena be ignored but specifically endorsed the principle that patent claims should be "considered as a whole." [46]

Mindful of this Court's concern for treating claimed subject matter as a whole even where mathematical algorithms are present, the C.C.P.A. has attempted to develop an analysis "to establish the relationship between the algorithm and the physical steps or elements of the claim." [47] This analysis includes evaluation of the claim (including the mathematical algorithm) as a whole, and determining if

> "the mathematical algorithm is implemented in a specific manner to define structural relationships between the physical elements of the claim . . . or to refine or limit claim steps . . . the claim being otherwise statutory. . . ." [48]

This developing analytical format is consistent with *Flook* and appropriately encourages progress in the useful

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[46] *Flook*, 437 U.S. at 594, n.16. *See also* the patent claim in *Mackay Radio and Telegraph Co.* v. *Radio Corp. of America*, 306 U.S. 86 (1939), cited with approval in *Flook*.

[47] *Walter*, 618 F.2d at 767.

[48] *Id.* Thus, for example, in *In re Sherwood*, mathematical expressions of geophysical principles were not ignored but rather were considered in relationship to the recited, stepwise manipulation of man-made seismic signal data which was employed to produce another man-made physical thing—an improved map of subterranean formations such as Figure 8 of Appendix B.

arts by rewarding the innovative applications of principles of nature or scientific truths to practical technological environments, without sanctioning the removal of the underlying principles or truths from the public domain.

D. Specific Processes For Dealing With Practical Technological Problems Are Patentable Subject Matter Whether Or Not Digital Data Processing Equipment Is Used In Their Practice

The fault petitioner finds in the *Diehr* and *Sherwood* inventions is not related to constitutional and statutory provisions. The technologies of rubber molding and seismic prospecting clearly are within the useful arts.[49] It is equally clear that there is nothing in 35 U.S.C. § 101 from which one might conclude that Congress intended to exclude the processing of rubber or the processing of seismic traces from the reach of the incentive system provided by the patent laws.[50]

The government attack springs from terminological confusion that irrationally equates all *algorithms* with *phenomena of nature* (and the other terms, such as *laws of nature, abstract ideas,* and *principles,* used interchangeably with it). *Mathematical formulae* get mixed up in the middle, presumably because *some* mathematical formulae describe prenomena of nature and because *some* algorithms are for solving mathematical formulae. Digital computers get tacked on because of assumed relations with algorithms.

The *Chakrabarty*[51] explanations of *Flook* point to a path through the maze. The limits of § 101 are geared to

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[49] *U.S. Const.*, Arl. 1, Sec. 8, Cl. 8.

[50] The terms of § 101 make "any new and useful process . . . [and] . . . any new and useful improvement thereof" eligible for the grant of a patent "subject to the conditions" of novelty (§ 102) and nonobviousness (§ 103), and the other requirements of the statute. And, 35 U.S.C. § 100 says "process" means not only a process but also a new use of a known process.

[51] *Diamond* v. *Chakrabarty, supra* note 17.

"laws of nature, physical phenomena, and abstract ideas" because these *are* "manifestations of . . . nature, free to all men. . . ." [52] Whether a particular patent claim is directed to nonstatutory subject matter is to be determined by scrutinizing it in light of the principles which proscribe patents for abstract ideas and phenomena of nature.[53] It would violate these principles if it were something that "has always existed" [54] or if it were so general as to be outside the "useful arts." [55] Other subject matter would pass the § 101 test and would then be evaluated for novelty and non-obviousness under §§ 102 and 103 of the statute.[56]

Under this approach the intent of Congress evidenced by the broad language of the statute would be honored and the incentives of the patent system would be restored in areas which the Patent Office now seeks to block off without authorization from Congress.

The approach also would be consistent with the prior holdings of the Court. The Court's concern in this area always has focused on laws of nature. Mathematical formulae (and computations concerning them) have never been considered objectionable outside this context of naturally occurring phenomena that have always existed.[57] Patent

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[52] *Id.* at 4715. *Flook*, it will be recalled, had itself explained that a scientific principle reveals a relationship that "has always existed" (437 U.S. at 593, n.15) and cannot therefore be new.

[53] *Chakrabarty*, 48 U.S.L.W. at 4717.

[54] *Flook*, 437 U.S. at 593, n.15.

[55] *U.S. Const.*, Art. 1, Sec. 8, Cl. 8; 35 U.S.C. § 101.

[56] An early portion of the opinion of the C.C.P.A. in *In re Bergy*, 596 F.2d 952, 960 (1979), presents an accurate explanation of the relationship between Sections 101, 102 and 103 of the Patent Law and the types of evaluations appropriate to each of them. An endorsement by the Court of this explanation would be a major contribution toward elimination of confusion in the law.

[57] *See Mackay, supra*, note 46.

claims with formulae or computation steps are not precluded as long as they represent concrete solutions to technological problems rather than abstract expressions of principles of nature or scientific truths.

V. CONCLUSION

The decision of the court below is correct and should be affirmed.

Respectfully submitted,

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APPENDIX

APPENDIX A

In the Matter of an Application by IBM for the Revocation of Letters Patent No. 1,352,742 in the Name of Frederick Nymeyer

PATENTS APPEAL TRIBUNAL

Royal Courts of Justice,
Monday, 16th October, 1978

Before:

MR. JUSTICE GRAHAM

and

MR. JUSTICE WHITFORD

In the Matter of THE PATENTS ACT, 1949,

and

In the Matter of AN APPLICATION by INTERNATIONAL BUSINESS MACHINES CORPORATION for the Revocation of Letters Patent No. 1,352,742 in the name of FREDERICK NYMEYER.

(On Appeal from the Decision of the Superintending Examiner (Mr. A. L. Pheasey) dated the 19th April, 1977)

(Transcript of the Shorthand Notes of Marten Meredith & Co. Ltd., 36-38 Whitefriars Street, London EC4Y 8BJ.)

MR. T. A. BLANCO-WHITE, Q.C. and MR. P. PRESCOTT, instructed by Mr. Lawrence Perry (IBM), appeared as Counsel for the Appellants (Applicants for Revocation).

MR. G. D. EVERINGTON, Q.C. and MR. N. PUMFREY, instructed Messrs. Stanley, Popplewell, Francis & Ross, appeared as Counsel for the Respondent (Patentee).

DECISION

MR. JUSTICE GRAHAM: Mr. Justice Whitford will deliver the judgment of the Tribunal.

MR. JUSTICE WHITFORD: This is an Applicants' Appeal on an Application to revoke Letters Patent No. 1,352,742

standing in the name of Frederick Nymeyer. The applicants, International Business Machines Corporation (IBM) have a considerable business in the field of equipment used in data processing. This includes apparatus of a type commonly referred to as computers. The title of the patent is "Improvements relating to Data Processing". Claims 1 to 7 are directed to a data handling system, claims 8 to 14 to a method of using a data handling system, claims 15 to 22 to a method of programming a data handling system, claim 23 to a computer programmed in accordance with the method claims, claim 24 to programming means in physical form suitable to programme a computer by any one of the method claims while the remaining claims are for methods of processing electric signals and the signals when processed.

The sole ground of objection argued on appeal was that the subject of the principal claims is not an invention within the meaning of the Patents Act 1949.

The case was listed in the Patents Court but when it was called on a preliminary question was raised as to whether we ought not to be sitting as the Patents Appeal Tribunal. The hearing of appeals from the Comptroller under the continuing provisions of the 1949 Act is dealt with in Schedule 4 of the transitional provisions to the Patents Act 1977. Section 11(3) of Schedule 4 provides that where an appeal has been instituted before the Tribunal before the appointed day and the hearing of the appeal has begun but has not been completed before that day, the appeal (and any further appeal) shall be continued and disposed of under the old law. 11(4) provides where such an appeal has been so instituted but the hearing of it has not begun before the appointed day, it shall be transferred by virtue of this sub-paragraph to the Patents Court on that day and the appeal (and any further appeal) shall be prosecuted under the old law, but as if

references in the 1949 Act and rules made under it to the Appeal Tribunal were references to the Patents Court. This appeal was instituted before and was called on before the Patents Appeal Tribunal before the appointed day. It was then adjourned to be heard before the Patents Judges sitting *in banc*. We are of the opinion that under the transitional provisions the appeal should be treated as having begun before the Patents Appeal Tribunal but as, in any event, it was agreed on all sides that the old law applies the question is of no importance so far as the issues of substance are concerned.

As was pointed out to us at an early stage, the test as to whether an invention is patentable may, on the face of it, have been radically changed by the 1977 Act. We however have to consider the position under the old law. Our decision is a decision under the provisions of the 1949 Act. We venture no opinion as to what the conclusion under the 1977 Act might be. Nor do we think it appropriate to take into consideration in reaching our conclusion any consideration of the possible effects of the 1977 Act or the probable attitude of the European Patent Office to claims in the field which we have to consider in the light of the Guidelines for Examiners in the European Office touching computer programmes which have already been issued and to which we were briefly referred.

The question as to whether all the more far reaching claims should be denied protection has been simplified by the very reasonable concession made on both sides that the matter can be tested on the first claim in the Patent under consideration.

The decision under appeal sets out on pages 1 to 3 the nature of the data processing with which the specification is concerned so clearly that we shall not attempt to improve upon it. We agree that it is plain that this patent derives from an idea Mr. Nymeyer conceived as to the

best way of determining a selling price for, for example, a stock or share namely that this could best be done by an automatic computation involving a comparison of buying orders and selling orders so as to arrive at a price having the lowest buy order price equal to or greater than the nearest sell order price.

Such an operation could in theory be done without the need for any automatic aids but in practice needs to be automatically computed. Mr. Nymeyer envisaged the making of the comparison and the determination of the price with the aid of a computer and so arrived at a system involving in the language of claim 1:

> 1. "A data handling system suitable for establishing prices for a given kind of fungible goods as hereinbefore defined in an auction market as hereinbefore defined, comprising data storing means suitable for storing data representing buy orders for the goods and representing sell orders for the goods, order entering means suitable for entering data representative of individual buy and sell orders including price information in said data storage means, comparing means which in use read out and compare the prices of buy and sell orders from the data storage means, by pairs chosen by progressing sequentially and simultaneously through a descending sequence of the buy orders and an ascending sequence of the sell orders by price, and means arranged to be controlled by said comparing means so as to select the price at which the goods are to be sold in dependence on the price or prices of the last compatible pair of orders which are matched and so as to select each paid of said buy and sell orders to be executed as a sale at a transaction price".

The question is whether this is an invention within the definition to be found in section 101 of the Act which, together with section 6 of the statute or monopolies, is to

be found set out at page 5 of the Decision. The question is whether the data handling system of claim 1 is a manner of new manufacture. These words have over the years been considered and reconsidered in a great many authorities. Counsel for IBM of course accepted that a data handling system, being an apparatus having components which carry out the functions required by claim 1 is a manner of manufacture. His fundamental objection was that in the view of IBM claim 1 covers, inter alia, a standard computer and accordingly in its present form cannot be said to be directed to a manner of new manufacture.

We were not taken through the body of the specification but counsel for IBM told us, and counsel for Mr. Nymeyer did not dissent, that the specification does envisage the use of a special comparator as part of the mechanism of the computer and it is conceded that if claim 1 or any other claim were limited to a computer embodying such a special comparator the objection upon the ground advanced would not be open. He said also, however, and counsel for Mr. Nymeyer again concurred, that at least one of the standard computers made and sold by IBM would be capable of storing the relevant data, making the necessary comparison and selecting the appropriate price if it were programmed to do this.

Now IBM do not on this application dispute the novelty of Mr. Nymeyer's concept but they say, and in our view rightly, that his idea of selecting a price by making a comparison of buying orders in descending order and selling orders in ascending order is not a manner of manufacture. They go further, however, and say that even on the assumption that the idea is new and not obvious it does not become a manner of manufacture if you do no more than call in the aid of an ordinary computer to do the work for you.

It was not suggested on Mr. Nymeyer's side that his idea could be the subject of patent protection. The authorities

to which we were referred show clearly that you cannot get protection for a mere idea and we need not refer to them.

If claim 1 on its true construction protects Mr. Nymeyer's business scheme however carried out it must be bad. If it can be so construed as to cover no more than a standard IBM computer it must be bad. We do not doubt that the standard IBM computer is capable of storing the relevant data (buying orders and selling orders). We do not doubt that the standard computer is capable of making the relevant comparisons. Indeed the specification of the patent seems to acknowledge that comparisons of this kind are a standard operation (see page 16 lines 85-89). We do not doubt that the standard computer can make the relevant selection but it is agreed that it can only carry out these operations when it is programmed to do this. The claim only covers a system in which there are means arranged to be controlled by the comparing means so as to select the price. If a novel comparator is used in the computer to exercise the necessary control no objection can be taken. If there is no special comparator then in our view the claim on its true construction still only covers a computer when it is programmed to produce the required result and does not cover a standard computer as such. As we understand it, a programme is a series of instructions which are fed to the other equipment in the data processing system to produce a desired result. It is possible to have a computer in which a number of different programmes are stored to be used as and when required. Alternatively a particular programme may be fed into a computer from outside. These programmes, written in a language the computer can understand, have taken different physical forms. These forms have included punched cards, punched tape, printed directions which can be optically scanned and now, more commonly, magnetic information stored on tape, wire or drums. It is not suggested that before Mr. Nymeyer came along there ever had been a computer programmed

to carry out the operations required in conducting his system. The Superintending Examiner has found, and this we entirely accept, that once Mr. Nymeyer conceived his idea any competent computer programmer could have told him how to programme a standard computer so as to produce the desired result. As matters stand, however, until Mr. Nymeyer came along there was no reason to suppose that anyone would have thought of writing the appropriate programme and building it into a computer or otherwise putting it into a physical form suitable for use with a standard computer.

A computer programmed to carry out Mr. Nymeyer's system must we think be considered as being an apparatus having novel characteristics but IBM say that in as much as it can be said that by the introduction of this new programme a change may have been brought about this is not a change in manufacture. Counsel for IBM put it in this way that such "newness" as there may be is purely intellectual. This cannot in our view be right. There must be different holes in the card or different magnetic patterns on the tape, or some other automatic control imposed to ensure that the computer carries out the particular operation required.

We must turn now to certain recent authorities touching the question of patentability of improvements relating to data processing. In *Slee & Harris's Application* (1966 R.P.C. 195) a claim to a method of operating a computer with a programme involving iterations characterised in that succeeding iterations were initiated before completion of the previous iteration was rejected, but a claim to a computer programmed to produce this result was accepted as was a claim to means for controlling a computer (programming means) to produce this result. The decision was a decision of the Patent Office. In it the Superintending Examiner observes, in relation to the claim to a computer programmed to produce the result, "It is directed to a ma-

chine which has been set into such a condition that it can proceed to solve a particular programme by undertaking a series of specified steps. It may be regarded as a machine which has been temporarily modified. No objection should in my view be raised by the Comptroller against such a claim on the ground that the invention concerned is not within the statutory definition". He further observes on the same page, page 198 of the Report, in relation to the claim to programming means, "The means claimed is more than a record of a programme, it is an integer which physically co-operates with a computer to control the latter to operate in a certain way. The means can, therefore, be likened to a cam shaped according to certain formulae so that, when fixed into a machine, it controls the latter in a certain way".

Badger Company Incorporated's Application (1970 R.P.C. 36) was a case in the Patents Appeal Tribunal. The claim under consideration was directed to a method of producing a drawing with the aid of a computer involving a series of steps as set out in the decision of Lloyd-Jacob, J. at page 39, line 33. Lloyd-Jacob, J. held that the claim as originally framed was not directed to a manner of new manufacture but suggested that it could be re-drafted in the form of a claim to a process for conditioning the operation of a computer or a computer of known type arranged to produce the solution and certain claims as finally accepted are to be found set at page 41 of the report.

In the same volume in *Gever's Application* reported at page 91 the Tribunal allowed a claim to:

> "A data processing apparatus for recording the registration of word marks by means of mechanographic supports arranged in a filing zone, the said word marks being transcribed by replacing certain letters or combinations of letters when occurring therein by other letters or combinations of letters"—that is to say, the letter Y by the letter I, the letters CI by the letters SI and any double letters by a single letter—"the said

already stated, there can only be one answer to the question, namely, that it is a manner of manufacture and I so hold.

"The second point which arises on the proposed claims is whether a punched card having holes in it embodying information according to the claimed rules of transcription can also be properly claimed as a manner of manufacture. To my mind such a card is no different from the "means" in *Slee & Harris's Application* or from the cam therein referred to at page 198, line 45. It is to my mind clear that a newly invented lathe, the tool of which is constrained by a cam to take a certain path in cutting, for example, a gear wheel, is a manner of manufacture. It is equally clear that such a cam could be made the subject of a subsidiary claim in a patent for the lathe. As sold, or as it lies on the table, of course such a cam could only have a potential usefulness, but it seems to be that it would be quite right that a claim should be able to be made to such a cam because it is in the circumstances envisaged novel and inventive and produces a useful result when it is placed in the machine for which it is designed. It is exactly analogous to, for example, a new type of carburettor which is necessary for the motor car for which it is intended. It seems to me impossible to argue successfully that such a carburettor or such a cam is not a manner of manufacture within the section.

"I cannot see that a punched card is in any different position. If the card was in fact shaped so that it could be used in place of a metal cam its contour being followed by some sensing device, it seems there could be little argument. How can it make any difference that the card is punched instead of being contoured? It is to my mind properly to be regarded as a manner of manufacture since it is shaped in a particular way,

namely, by having holes in it at certain specified positions which ensure that it is capable when placed in its machine of controlling that machine in accordance with pre-determined directions. In this respect it seems to me to differ from a card which is merely printed and which is intended to convey information to the human eye or mind but which is not intended to be ancillary to some machine being specially shaped or constructed for that purpose".

In *Burroughs Corporation (Perkins') Application* 1974 R.P.C. 147 the Patents Appeal Tribunal sitting *in banc* accepted claims in these terms:

"8. A method of transmitting data over a communication link between a central processor and designatable ones of a plurality of addressable remote data terminals coupled by said communication link to said central processor, said method comprising the steps of generating a sequence of inquiry messages at said central data processors, transmitting said inquiry messages from said central processor to said remote data terminals via said communication link in a multidrop mode, storing terminal address data at each remote terminal, said terminal address data designating the address of the remote data terminal at which it is stored, temporarily storing received inquiry messages at each of said data terminals receiving said inquiry messages, withdrawing from storage at each remote data terminal receiving an inquiry message the terminal address data designating the address of that data terminal, comparing said terminal address data with an address portion of said inquiry message at each remote data terminal, receiving said inquiry message to determine whether such received message is addressed to the terminal receiving such inquiry message enabling the addressed data terminal to respond to said inquiry message, and selectively changing the ter-

minal address data stored at at least one of the said remote data terminals to selectively inhibit that data terminal from recognising an inquiry message having an address portion corresponding to the original terminal address data of said data terminal before said terminal address data was altered.

"9. A method as claimed in claim 8 which includes the steps of recognising the failure of an addressed data terminal to respond to a poll-select type inquiry message addressed to it, and changing the poll-select type inquiry message whenever an addressed data terminal fails to respond to an inquiry message of one type addressed to it.

"10. A method as claimed in claim 8, which includes the step of transmitting a control character from a data terminal to said central processor whenever said data terminal receives an inquiry message addressed to it and its normal terminal address data has been modified.

At this stage it had become the Office practice to allow claims to computers programmed in a particular way and also to computer programmes embodied in such physical forms as punched cards or tape. The objection to these particular claims was that, being in form directed to a method of transmitting data or for controlling a computer, as opposed to claims for a method of programming a computer, the product to which they must be considered as being directed could be said to be no more than intellectual information.

We do not propose to review again the authorities referred to in the judgment in *Burroughs' Application* many of which were referred to on the present hearing. We remain of the opinion which is to be found expressed on page 160.

"If a claim, whatever words are used, namely, whether the claim is, for example for a method of transmitting

> data . . .,' 'A method of controlling a system of computers' or 'a method of operating or programming a computer . . .', is clearly directed to a method involving the use of appratus modified or programmed to operate in a new way, as the present claims are, it should be accepted".

We proceed upon the basis that the only thing that was novel in connection with the present application was Mr. Nymeyer's concept of the way in which a price could be fixed, but what he seeks to claim as a manner of new manufacture is a method involving operating or controlling a computer in which, so far as the contested claims are concerned, the computer is programmed in a particular way or programmes in physical form to control a computer so that it will operate in accordance with his method. The method is embodied in the programme and in the apparatus in physical form and in our view the Superintending Examiner was right in concluding that the claims should be allowed to proceed. It certainly cannot be said of any of these claims that under the old law they are clearly not directed to a manner of new manufacture.

We were additionally referred to two cases in the U.S. Supreme Court. In the first of these *Gottschalk* v. *Benson* 1972 409 U.S. page 63 Mr. Justice Douglas, who gave the opinion of the Court, observes at page 71:

> "It is conceded that one may not patent an idea. But in practical effect that would be the result if the formula for converting BCD numerals to pure binary numerals were patented in this case. The mathematical formula involved here has no substantial practical application except in connection with a digital computer, which means that if the judgment below is affirmed the patent would wholly pre-empt the mathematical formula and in practical effect would be a patent on the algorithm itself.

> It may be that the patent laws should be extended to cover these programs, a policy matter on which we are not competent to speak."

In the case before us there is no attempt to patent a formula or its equivalent. The claims are directed to apparatus arranged to operate in a particular way.

In *Parker* v. *Flook* 98 S.Ct., page 2522 the Court was divided as to the extent to which a novel feature in the form of a mathematical formula or algorithm could be protected. Mr. Justice Stevens observes, in giving the majority decision of the Supreme Court, that the Supreme Court was considering section 101 of the U.S. Patent Code and it is plain it was not considering the United Kingdom Act of 1949. He specifically observes: "Respondent's process is unpatentable under section 101 not because it contains a mathematical algorithm as one component, but because once that algorithm is assumed to be within the prior art the application considered as a whole contains no patentable invention. Even though a phenomenon of nature or mathematical formula may be well known, an inventive application of the principle may be patented. Conversely the discovery of such a phenomenon cannot support a patent unless there is some other inventive concept in its application".

We agree with the Superintending Examiner that under the Act of 1949 and the decided cases the law is that an inventive concept, if novel, can be patented to the extent that claims can be framed directed to an embodiment of the concept in some apparatus or process of manufacture.

The appeal must stand dismissed.

MR. EVERINGTON: My lords, I ask for costs. By tradition, going back to, at any rate, the last century, and the practice of the law officers, the costs awarded are not on an indemnity basis but a contribution towards the costs. The only

thing I would say in this case is that the patentee here is an individual and this is, as my learned friend has said, quite clearly a test case by a large corporation and in those circumstances I do ask your lordships to make a generous contribution.

MR. PRESCOTT: First of all, to deal with the question of costs, it is my understanding that our respective clients agreed beforehand that if IBM won they would not ask for costs at all. We are astonished, however, to hear that they are asking for indemnity costs in the event of us losing. I would simply observe that this is an ordinary case in the Patent Appeal Tribunal and your lordship should be invited to proceed in the usual way in making a contribution.

MR. JUSTICE WHITFORD: I did not understand Mr. Everington to ask for indemnity costs. I thought he asked for a generous contribution.

MR. PRESCOTT: My lord, it is a case which is no more difficult or involved, in fact less so because of the sparsity of the evidence required. It is a case which has not taken up much time either here or below.

MR. JUSTICE GRAHAM: What happened in the court below?

MR. EVERINGTON: £150, my lord.

MR. PRESCOTT: We would ask for the normal sort of scale in these case and that it should not be treated differently.

MR. JUSTICE GRAHAM: We think the right order is £250 costs.

MR. PRESCOTT: I have an application which I am instructed to make for leave to appeal to the Court of Appeal. May I make two points in connection with that. First of all, this is quite a different kind of case from the previous computer programming cases which have been before this tribunal.

MR. JUSTICE GRAHAM: Why do you say that?

MR. PRESCOTT: We are here not concerned, as I think all the other cases were, with matters of form, in other words, whether it makes any difference to frame or claim a machine when programming as opposed to a programme. I think we conceded at the outset that we did not care how it was put, a machine when programmed or a card full of punched holes, it is all the same. The point of substance we make is this: there is, with respect, no attempt here to distinguish between two kinds of "newness" in punched cards, to take your lordship's illustration. Your lordships made the point that if you have a punched card which has holes in it and that pattern of holes is novel, then you have got a novel article of manufacture and a manner of new manufacture. My lords, there must be a distinction between a punched card with holes in its which is new which is intended to feed a musical box and play a new tune and whose only novelty lies or derives from the novelty of the tune, and a punched card which might serve, for example, to control a machine to produce a new kind of shaft or other article of manufacture.

MR. JUSTICE GRAHAM: You say there must be a distinction between those two?

MR. PRESCOTT: My lord, I submit so; otherwise the effect of your lordships decision would be this, that all you have to do is to come before the Patent Office and say, "I have a new tune which I thought up yesterday. I want to make it suitable for a musical box. Here is my punched card suitable for fitting into a standard musical box. Nothing like this punched card has ever been seen before, it is new, non-obvious, an article of manufacture and therefore I demand to patent it". It goes further than that, because by parity of reasoning we must extend the protection to have any good to the actual grooves in a gramophone record.

MR. JUSTICE WHITFORD: When you mention a musical box it is a box which is intended to function in the same old way.

MR. PRESCOTT: In the same old way but in a totally new manner; so perhaps now we are going to what we consider the distinction is. The point is there and I will not elaborate it here, because after all your lordships have given a long and reasoned decision. I do submit it is a point of first class capital importance and leave should be granted.

MR. JUSTICE GRAHAM: The trouble is that this is under the old law. It is a pity in a way that we are not acting under the new law. No doubt you will in the next case.

MR. PRESCOTT: The new law may well have effect for the next 20 years.

MR. JUSTICE GRAHAM: Yes, I know, but this is the old law.

MR. PRESCOTT: I am sorry, the old law may have effect for the next 20 years. It may proceed some way into the future.

MR. JUSTICE GRAHAM: What do you say, Mr. Everington?

MR. EVERINGTON: As your lordship points out it is only a question under the old law. The old law was tolerably clear and established by the cases your lordships referred to. In my submission this really does not carry the matter any further in this case and simply reaffirms what has already been settled as the old law.

MR. JUSTICE WHITFORD: None of it has ever gone to the court of appeal. It is going to have effect probably to a number of cases.

MR. EVERINGTON: Yes, my lord.

MR. JUSTICE WHITFORD: So on those, if they ever come before the courts, the decision of the Appeals Tribunal will not in any sense be conclusive certainly.

MR. EVERINGTON: That is right, my lord.

MR. JUSTICE GRAHAM: I think we can give you leave to appeal.

MR. EVERINGTON: May I just say this on the question of costs here. As I pointed out my client is an individual, and the costs in the Court of Appeal will be the ordinary costs awarded by the Court of Appeal. My lord, as this is a test case, and the case of a large company taking an individual up before the Court of Appeal, I would ask your lordship to consider whether leave should not be conditional upon the applicants paying the costs in any event.

MR. PRESCOTT: I understood your lordships to have given leave.

MR. JUSTICE GRAHAM: That argument had not been put up. The order is not finalised yet.

MR. PRESCOTT: There are two aspects on this. As I said earlier IBM had already decided even if it won not to ask for their costs here because we are an international corporation of very great stature and do not want to be seen to be pushing people around. It is one thing to say, if one likes, out of a sense of generosity one should not do that, but it is another thing to be treated as a matter of law——

MR. JUSTICE GRAHAM: It is not a question of a matter of law but what is the right thing to do in the circumstances.

MR. PRESCOTT: There is no reason why we, in order to protect what we conceive to be our rights, that we should be treated any different from any other litigant.

MR. JUSTICE WHITFORD: All right you get leave and nothing is said as to costs, and maybe Mr. Nymeyer decides he cannot appear before the Court of Appeal because of the burden of costs. I think it would be unfortunate in a case of this kind which may vitally affect the interests of IBM in wholly different cases that it should be argued before

the Court of Appeal without the assistance of counsel on the other side.

MR. PRESCOTT: Your lordship, if I may say so, is absolutely right. I wonder if your lordships would consider making a recommendation to suitable quarters in such a case that it might be a case for an amicus to assist the court in the event of that situation transpiring. One must have regard to the distinction as to what might happen in practice. I dare say in practice we would be horrified if he threatened to drop the case because of lack of funds, but in reality as we are here we ask not to be treated differently to anybody else.

MR. JUSTICE GRAHAM: I think we will adjourn for five minutes.

(*Their lordships left the bench.*)

MR. JUSTICE GRAHAM: The order that we make is as follows: we do give leave to appeal and it will be appreciated we can not in any way tie the hands of the Court of Appeal as to what they may think is the right course to take. This is obviously an important case from the point of view of IBM and we recognize that probably the first opportunity they have had of going to the Court of Appeal in order to get the matter fully tested, but we do hope that they will consider their position as a result of today with a view to making it clear to Mr. Nymeyer that in the event of their prosecuting the matter in the Court of Appeal they will not ask for an order as to costs. In any event, if Mr. Nymeyer feels he is unable to take part in the proceedings in the Court of Appeal we think that IBM should make it clear to the Court of Appeal what the position is and ask them whether or not they would like to make an order that they have an amicus curie to assist them in the Court of Appeal. We appreciate that this is a matter which ought to be argued fully on both sides in order to arrive at a proper decision. Is that clear?

MR. PRESCOTT: That is clear. Although we do not have definite instructions, therefore I cannot definitely commit my clients, it would not surprise me in the slightest if your lordships' comments fall on receptive ground.

MR. JUSTICE GRAHAM: That is what we rather expected you might say from people of your calibre.

MR. PRESCOTT: If your lordship pleases.

APPENDIX B

FIGURES 7 AND 8 FROM THE
SHERWOOD PATENT APPLICATION

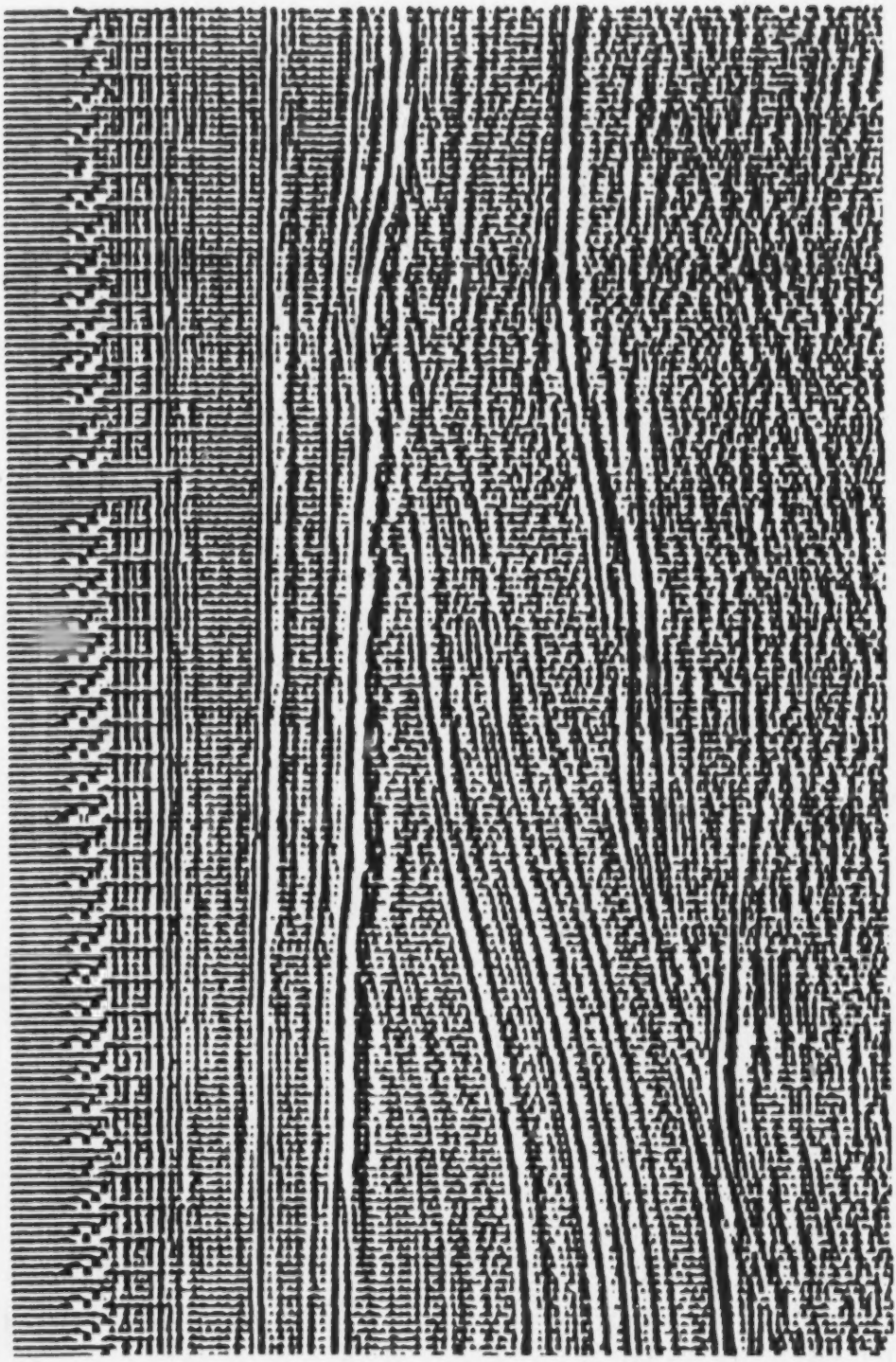

FIG. 7

INVENTOR
JOHN W. C. SHERWOOD
BY George W. Wasson
Ralph L. Freeland Jr.
ATTORNEYS

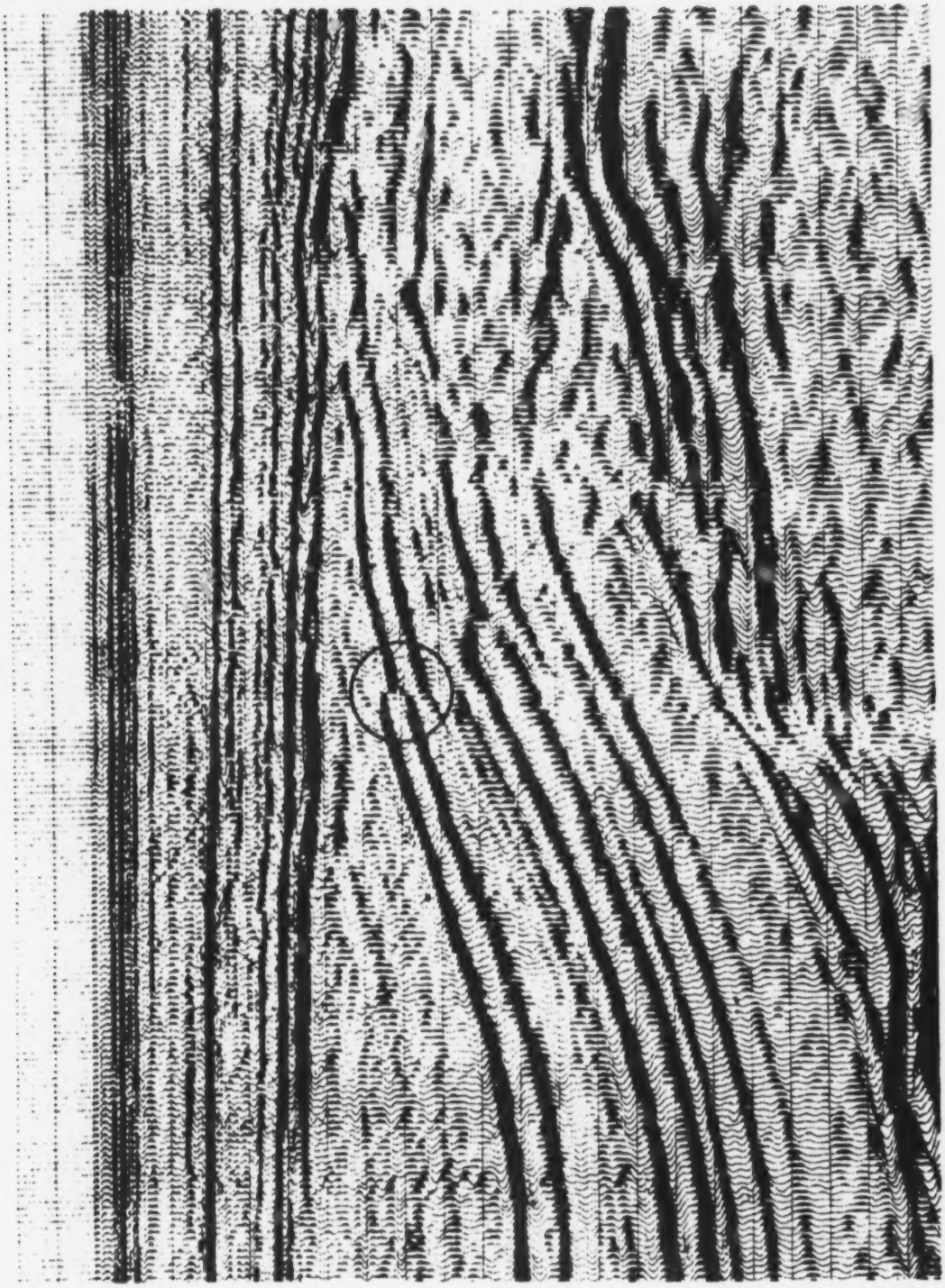

FIG. 8

INVENTOR
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see 7 9

8 5